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HOW TO CHOOSE AIRFOILS

MODEL AIRPLANE NEWS

48120

May 1992

THE WORLD'S PREMIER R/C MODELING MAGAZINE

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MAY 1992 VOLUME 120, NUMBER 5

MODEL AIRPLANE NEWS

THE WORLD'S PREMIER R/C MODELING MAGAZINE

FEATURES

ON THE COVER: *Electric R/C's ParaPlane Sport—the easiest-to-fly outdoor R/C ship we've flown, is shown in flight. Inset: Trinity's Pushed Panasonic SCR 1700mAh cells with Astro Flight connector.*

HELICOPTER SECTION

CONSTRUCTION

COLUMNS

DEPARTMENTS

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EDITORIAL

TOM ATWOOD

THE CALL TO DESIGN

A FEW YEARS AGO, I tossed a 4-foot length of 1/16-inch balsa sheet into the air as if it were a flying wing and, to my surprise, watched it sail a few feet into the air while tumbling like a leaf (i.e., the lower edge rotated in the direction of travel, and the top, back toward me). I attached two disks of cardboard to the ends to serve as rudders, which enabled it to fly across the room. The glide ratio was similar to that of a parasail or early Rogallo wing. I began to wonder: how well could this be made to fly?

Editor-in-Chief Tom Atwood test-flies the ParaPlane Sport. (Photo by Gerry Yarrish.)

A slightly more sturdy version with bearings on the ends, from which a crescent wrench was suspended, besides denting the walls, showed that the tumbling wing continued to maintain its glide ratio. It just tumbled and flew faster. Later, I found that Roy Clough, an inventive modeler whose name many will recognize, had published a photo of a free-flight airplane flying with this Flettner-type rotor wing—and theoretical discussion on it—in the May 1949 issue of *Model Airplane News*. Test-flying the ParaPlane Sport again brought this unusual rotor design to mind. Could one swap out the parachute for a rotor system? How about an R/C airplane version? Have any readers cracked this particular design nut?

DESIGN AND FLY

We've recently learned of plans for an unusual design challenge at an upcoming, annual fly-in held in Ontario. Contestants design an airplane, build it and test-fly it in under two hours, and then the serious competition (flying) starts.

Each team will receive one 3x4-foot sheet of artist's foamboard (1/4-inch-thick Styrofoam with card stock laminated to each side), two wooden yardsticks, two 36-inch dowels, CA and accelerator, a wire hanger, some Nyrod and hardware odds and ends. The team supplies a .25- to .35-size 2-stroke and a sheetrock knife. No other tools will be allowed, although razor saws and hand drills will be available (yes, hand drills).

If a team racks up a total of 120 minutes while designing, building and test-flying, impressive competition flying will later strip away the penalty points generated by those onerous minutes. Flying events will include straight and level flight, figure-8s and possibly touch-and-go's (landing gear is still being debated). One more thing: the competition will be videotaped, so each team is advised to designate a PR man. We'll have a reporter present to cover the fun (or the carnage).

AIRFOILS UNFOLDED

This issue includes the first in a two-part series by Andy Lennon on understanding airfoil plots. This material is useful if you want to select an airfoil to customize a kit or design your own plane. Although this area can get quite technical, the graphs and charts in this primer aren't that hard to use, and once you understand the basic principles, this information can add a new dimension to your modeling efforts.

EVENT UPDATES

Here's the latest on a few notable events. There are two confirmed unlimited races scheduled for 1992. The R/C Unlimited Racing Association is sponsoring an April 23 to 26 race in Tucson, AZ (entry deadline is April 4). For further information, call (602) 722-0607. "The Unlimited," a second racing organization, is sponsoring a September 23 to 27 race at Madera, CA (entry deadline is May 1). This event includes both an unlimited and a 1/5th-scale AT6 race. For information, call (310) 320-8369. Single-engine planes that qualified in the 1991 race at Madera will be eligible to compete in either race, provided the bare-block weight of the engine is under 14 pounds. Updated rules apply to all new aircraft. We understand that the organizers of the April race are also planning a November '92 race in Tucson, but this hadn't been confirmed as we went to press.

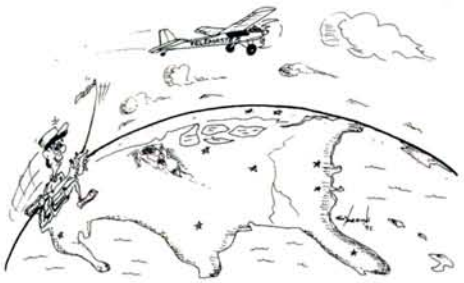
Pattern fliers may wish to note that the Wright Brothers Memorial Radio-Control Championships will be on held May 23 to 25 in Miamisburg, OH. This event shows signs of growing into one of the more important senior-level aerobatic championships, and the word is that major figures will be competing. For further information, contact Frank Knoll at (513) 433-6078.

The Byron Aviation Expo has apparently found a new home. A press release from the Greater Des Moines Convention & Visitors Bureau indicates that a soon-to-be constructed general aviation airport in Ankeny, IA, will be the home of future Aviation Expos. The lodging, international airport and local freeway systems bode well for the continued expansion of this unique R/C and full-scale exhibition.

Last, but by no means least, if you have any chance to attend Top Gun '92, to be held on May 7 through May 10 in Palm Beach, FL, don't miss it. It promises to be even more dazzling and technically impressive than last year's (see our September '91 issue for a peek at the action). Between 50 and 100 of the finest scale models in the world will be there, and this year the competition will include helicopters. For further information, call Frank Tiano Enterprises at (407) 795-6600.

AIRWAVES

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News,** 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.



AROUND THE WORLD IN 180 DAYS?

[In the April issue of Model Airplane News, the "Air Scoop" column (page 16) provided a summary of Yogendra (Yogi) Jahagirdar's plans to fly a Telemaster around the planet in mid-1992. This effort, which is called "Rotary's Trans World Aeromodel Goodwill Flight '92," is being undertaken by Yogi in association with Rotary International. Yogi has previously flown a Telemaster a cumulative distance of approximately 3,700 kilometers in a cross-country flight in India (this was just one of two such trips!). In the letter excerpted below, Yogi notes some of the challenges he faces in the U.S. portion of this attempted global flight. Although only time will tell whether Yogi will succeed, we view this as news of interest to our readers and are therefore publicizing his effort.]

I'm very happy that *Model Airplane News* is publicizing my venture. It isn't possible for me to complete the Trans World R/C Aeromodel Goodwill Flight unless I get active support from aeromodelers, especially in the U.S. and the U.K., in terms of information and participation.

We'd love to meet and spend time with aeromodelers along the route and even encourage them to join us for some time (in their own vehicles and at their own expense). We've identified 50 percent of our hosts in the U.S. If aeromodelers in any particular town were to help or associate with Rotarians in organizing elements of this venture, they could get involved without having to spend money.

I learned from the AMA that, to the best of their knowledge, no permission or clearance is necessary in the U.S. for this flight, but there could be ordinances against model flying in certain areas. They have asked me to get this confirmed—from whom and how is not yet known! I need help in this matter.

We don't intend to fly through cities, populated areas or any restricted areas. We have to depend on aeromodelers for this information. Is it necessary to inform the highway authorities or the police to get their cooperation? Can we use interstate highways for flying, or do we have to stick to secondary highways only? This will depend on the wind direction, flight duration, highway restrictions and availability of space for landing. I'm confident about flying from roads with a reasonable overgrowth of trees forming a canopy. The answer to this will vary from sector to sector, and a decision might have to be taken on the spot.

There's going to be a minor change in the schedule and the timing earlier published. The Orlando dates are, however, fixed for the Rotary International Convention. There will be a tail-wind component on most of the U.S. journey, except from New York to Orlando in May/June. We might, therefore, just drive down from New York to Orlando and then fly the model from Orlando to Kitty Hawk only on the return.

There's a suggestion from friends to fly from Buffalo, NY, to Boston to New York. Is this route feasible from the point of view of topography and wind direction?

We aren't allowed to take currency out of India, and Rotary clubs are only going to host us and organize functions. This does leave a financial deficit to be bridged. We also still seek sponsorship from airlines in some sectors to airlift the vehicle and the team.

The Indian Department of Posts is issuing a special cancellation to commemorate this flight. There will be beautiful envelopes with the likeness of the aircraft on it. They might issue a stamp after the flight is concluded. We'll actually be carrying letters in this model aircraft. When done officially, it will be the first international radio-controlled airmail!

I'm totally committed to this flight and have slogged for two years to bring the flight to this stage. I'm very optimistic (and realistic, too) and would leave no stone unturned to achieve the goal that I have set. I don't get disheartened easily either. I'm absolutely open for suggestions and comments on any matter concerning this flight. I look forward to hearing from you or potential supporters among your readership.

YOGI JAHAGIRDAR
c/o Event Secretariat
106/5, Erandwane
Ketkar Rd. Pune 411004
India

YOGI'S TENTATIVE ITINERARY

INDIA
March 14 - March 23
AUSTRALIA
March 24 - April 19
USA
April 20 ..... Los Angeles
24 ..... San Bernadino
25 ..... Blythe
26 & 27 ..... Phoenix
28 ..... Tucson
29 ..... Lordsburg
30 ..... El Paso
May 1 ..... El Paso
2 ..... Kent
3 ..... Midland/Odessa
4 ..... Arlene
5 & 6 ..... Dallas
7 ..... Texarkana
8 ..... Little Rock
9 & 10 ..... Memphis
11 ..... Nashville
12 ..... Indianapolis
13 ..... Chicago
14 & 15 ..... Evanston
16 ..... Southbend
17 ..... Toledo
18 & 19 ..... Michigan
20 ..... Battle Creek
21 ..... Detroit
CANADA
May 23 ..... London
24 & 25 ..... Toronto
26 ..... Hamilton
USA
May 26 ..... Buffalo
27 ..... Binghamton
28 & 29 ..... New York City
30 ..... Philadelphia
31 ..... Washington
June 1 ..... Richmond
2 ..... Norfolk
3 & 4 ..... Kitty Hawk
5 ..... New Bern
6 ..... Wilmington
7 & 8 ..... Charleston
9 ..... Savannah
10 & 11 ..... Jacksonville
12 ..... Daytona Beach
13,14-17 ... Orlando
18 ..... Kitty Hawk
19 ..... New York City
22 ..... New York - London
U.K.
June 23 - July 8
FRANCE
July 9 - 14
BELGIUM
July 15 - 18
NETHERLANDS
July 19 - 21
GERMANY
July 22 - August 1
POLAND
August 2 - 11
RUSSIA
August 12 - September 9
INDIA
September 9 - 20

(Continued on page 90)

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THE WORLD'S PREMIER R/C MODELING MAGAZINE

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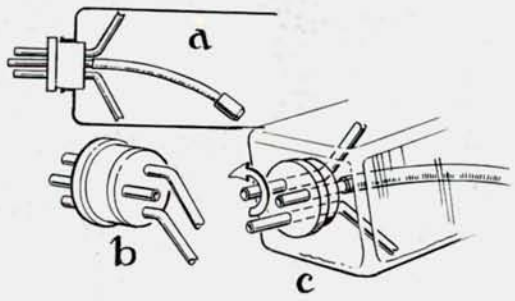
HINTS & KINKS

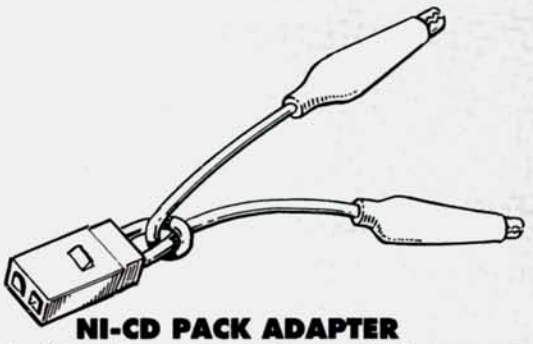
JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman c/o *Model Airplane News*, 251 Danbury Rd., Wilton, Ct 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive,we can't acknowledge each one, nor can we return unused material.



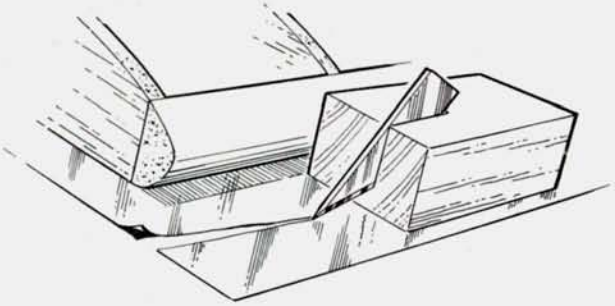
EASY THREE-PIPE INSTALLATION

It's impossible to insert a stopper into a tank with the pipes arranged as shown in (a). Arrange them as shown in (b), insert the stopper, and *then* turn the pipe so that it's positioned at the top of the tank, as shown in (c). If you use pliers to rotate the pipe, wrap tape around the jaws, and insert a drill bit of the appropriate size into the pipe. This will prevent the pipe from being crushed.. *Namsoo Park, Seoul, Korea*



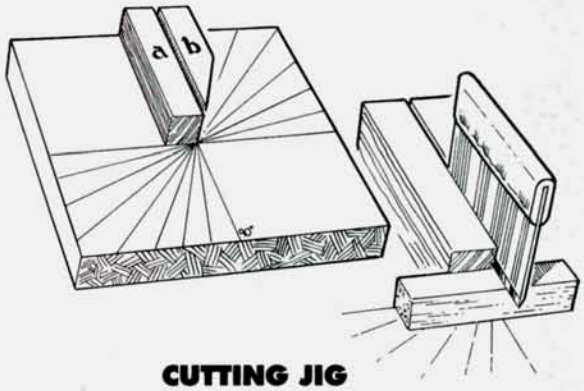
NI-CD PACK ADAPTER

This adapter lets you clip your power pack to more than just your models. The knot in the cable separates the insulated clips and prevents short circuits. *Mitchell Chin, Tappan, NY*



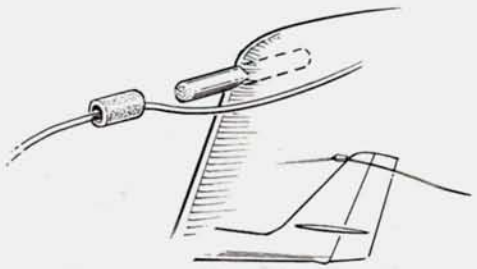
COVERING-FILM TRIMMER

With this gadget, you can cut "overlaps" in covering film that can be ironed up and over parts. Cut a slot in a wooden block, and glue a no. 1 X-Acto blade into it as shown. As you move the tool over the film, keep the block in contact with the edge of whatever you're covering (in this instance, a wing leading edge). *G. Thomas, Etobicoke, Ontario, Canada*



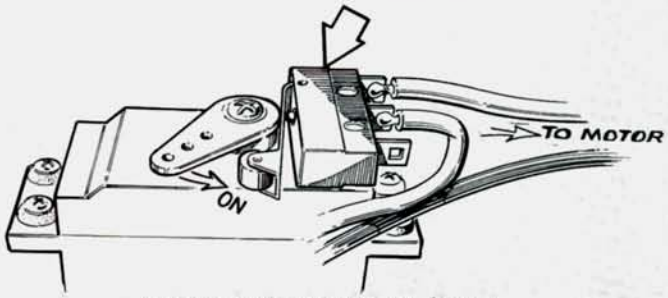
CUTTING JIG

This simple jig enables you to keep your blade upright while you cut balsa. Use a razor blade as a spacer between maple blocks (a) and (b), and glue them to the base. Remove the blade carefully before it's accidentally glued in place. Note: position the corner of block (a) at the intersection made by the guidelines. You can also custom-make such a jig for use with Zona or X-Acto saws. *Robert Hanen, Muskegon, MI*



ANTENNA ATTACHMENT

Here's a way to minimize the possibility of damaging your receiver or antenna wire. Just run the wire through a small piece of rubber tubing, as shown, and attach the tubing to a short dowel installed in the fin. If the plane makes a sudden, unplanned stop, the wire will be pulled free. This setup also holds the antenna in place neatly.
F. W. Walker Shaw, Lancashire, England



MICROSWITCH ON/OFF

You can mount a Radio Shack microswitch (no. 257-017) directly on the top of the servo using the existing servo-screw holes. Trim the servo wheel so that it will press against the mini roller and turn on the switch. Be sure to solder the wires to the switch's "common" and "normally open" terminals (often marked "C" and "NO").
Reuben Hadfield, Guelph, Ontario, Canada

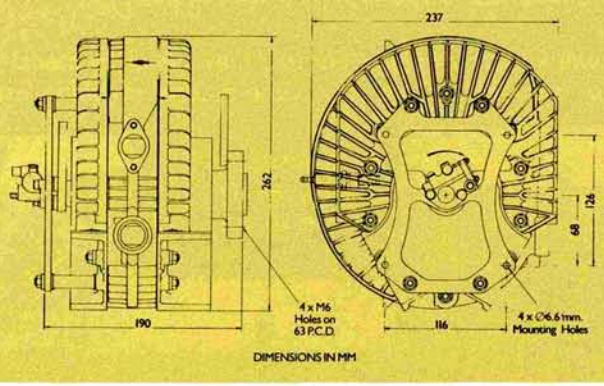
AIR SCOOP

CHRIS CHIANELLI

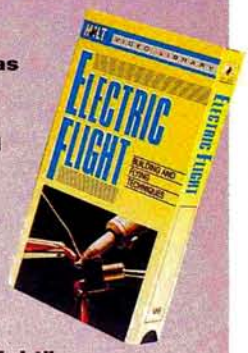
New products or people behind the scenes—my sources have been put on alert to get the scoop! In this column, you'll find news that will, at times, cause consternation, and telepathic insults will probably be launched in my general direction! But who cares?—it's you, the reader, who matters most! I spy for those who fly!

Norton ROTARY

Norton Motors Limited of Staffordshire, England, manufactures the NR 731 rotary engine that's used to propel target drones like this 160-pound R/C Banshee at 200mph. At 21.7 pounds, the NR 731 puts out an impressive 38hp. This is a little hefty, even for an unlimited racer. Director of Engineering Dave Garside said shaving weight isn't out of the question. The NR 731 is approximately 10.3 inches in diameter and 7.5-inches deep. For more information, contact Norton Motors Limited, Lynn Ln., Shenstone, Lichfield, Staffordshire, WS14 OEA, England; tel: 011-44-543-480101; fax: 011-44-543-481128.



ELECTRIC VIEW



The Milt Video Library, which has made many fine hobby videos, including "Model Airplanes" (the best "How-To" video of 1990 as awarded by the New York International Film Festival), adds "Electric Flight" to its list. This video covers all aspects of electric flight from custom battery-pack assembly to building and flying all types of model. Milt's "Electric Flight" also features professional cinematography—definitely not a basement tape. For more information, call Milt Associates at (914) 528-4117.

1/4-Scale Continental

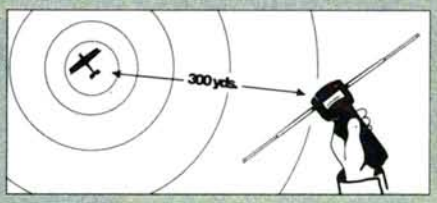
AIR SCOOP

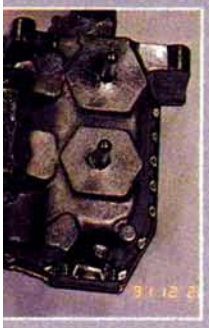
QUIET GIANT

The 14-inch-long SM-BMF Soundmaster muffler is designed specifically for giant-scale engines. It's conservatively rated for 4.2cid engines, but you can use this muffler safely on engines that measure up to 5.8ci. The word is that not only does the SM-BMF increase power, but it also reduces the sound of big engines so dramatically that, even close to the plane, it sounds like a cross between a big window fan and the family car! Like other Soundmaster mufflers, this one is made of thick, seamless, aluminum-alloy tube stock with machined ends. For more information, contact Davis Model Products, a division of DDD, P.O. Box 141, Milford, CT 06460; (203) 877-1670.

BEACON TRACKING SYSTEM

Have you ever had to search for hours—even days—for a model in thick woods or underbrush? You probably have passed very close to it without realizing it. Sometimes, the "search party" never finds it at all! Well, we've found a system that will probably work extremely well. Beacon's Arrow Tracking System, which incorporates micro-technology, could be easily adapted for model use and quickly switched from plane to plane. The system, which tracks up to 300 yards, includes a hand-held receiver with telescoping directional antennas, two arrow transmitters, an earphone, a 9V receiver battery, two lithium batteries for the transmitters batteries (80-hour life) and a transmitter carrying case. For more information, contact ETS Corporation, P.O. Box 839, Dundee, IL 60118; (708) 426-2215.





Some of you are already quite aware of Tom Pape's fabulous 5-cylinder radial, which debuted at the 1988 Scale Masters. Well, for those of you who aren't, the rest of the story is that Tom copied a real engine using a pantograph to make the radial exact scale. Now Tom has turned his attention to a Continental 0200 4-cylinder engine. As you can see from the photo, Tom used his homemade pantograph to duplicate the exact dimensions and shape of the full-scale Continental. Tom has promised to keep us well informed of the progress of this commendable undertaking.

Foot-Long Flier

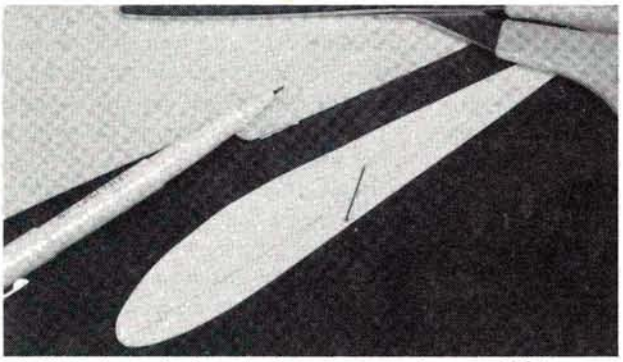
Do you remember the High-Tech Attack gyro saucer that we featured in the July '91 "Airscoop"? Well, Keyence, maker of the saucer, has introduced the 4-channel, 11-inch-long (from nose to tail-rotor shaft) Revolutor H-610. It has the same micro-concept design as the saucer, and it features twin gyros that are connected directly to its micro-electronic circuit board. The H-610 comes ready to fly, complete with a transmitter, and it reportedly flies as well as the gyro saucer. There's no word about availability at this time.

HOW TO:

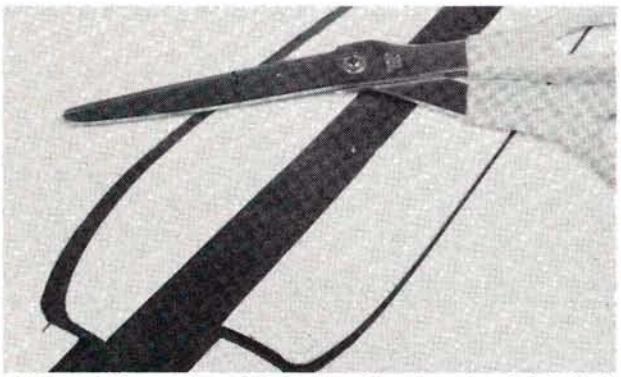
RANDY RANDOLPH

TAPERED WING RIBS

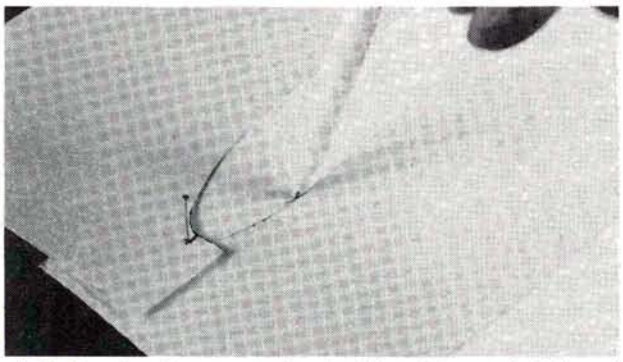
Many scratch-built projects use constant-chord wings because of the difficulty of plotting ribs of different sizes to produce a tapered wing. The photos show you an easy way to make such ribs.



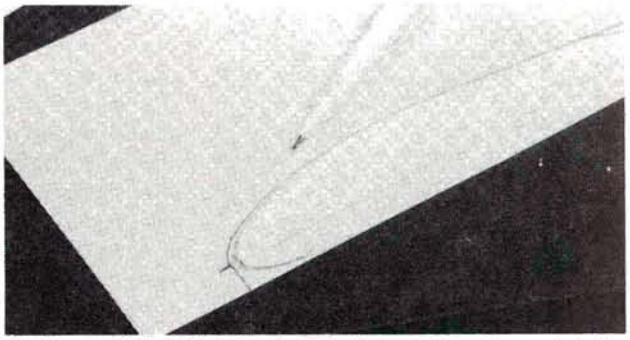
1. The tools required are: card-stock paper, scissors, a felt-tip pen, a root-rib template and a pin. On the rib template, draw a chord line from the center of the leading edge to the center of the trailing edge.



3. Repeat this procedure at the top of another piece of card stock. Position the template as before, and trace around its bottom. Draw a vertical line from the center of the leading edge to the top of the card stock. Cut the card-stock material out of the "outline" templates.

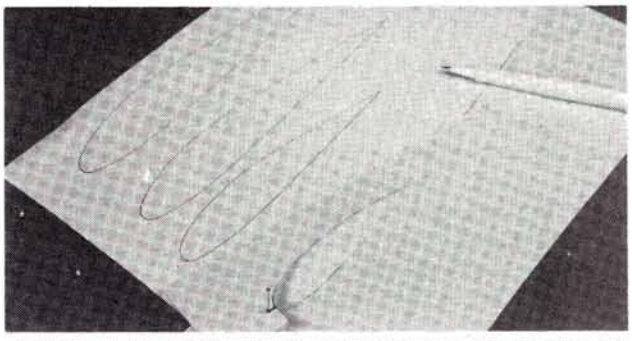


5. To draw the ribs, measure the chord line of the required rib, and adjust the pivoting templates so that the top one intersects the bottom one at the measured distance. Trace the outline formed inside the pivoting templates.



2. Measure at least 1/2 inch up from the bottom edge of the card stock, and draw a line parallel to the edge. Position the rib template on the card stock so that the chord line is directly over the line on the card stock. Trace around the top of the template from the leading edge to the trailing edge. Draw a vertical line from the center of the leading edge to the edge of the card stock.

4. On both the top and bottom templates, measure and make a mark 1/8-inch in front of the leading edge on the chord line. These locations will be where you'll pierce both templates with the pin to create a pivot. When the templates are joined and adjusted properly, the rib "area" they form should be identical to the center-rib template.



6. To complete each rib, draw the spar locations and the leading and trailing edges. Although this isn't the most precise way to generate tapered sections, it's accurate enough for most applications.

FIFTY YEARS AGO

ART SCHROEDER

500,000 MODELS

FIFTY YEARS AGO, many modelers knew the role they'd play in America's war effort. Thousands would be called to all branches of service; many to the air arms. But just as many were either too young or too old for active service.

Those of us who had reached our early teens were particularly vulnerable at this time. We had no real concept of the meaning of war. We didn't have adult insights into what lay ahead. Yet we wanted to help in some way. It wasn't long before we had our chance.

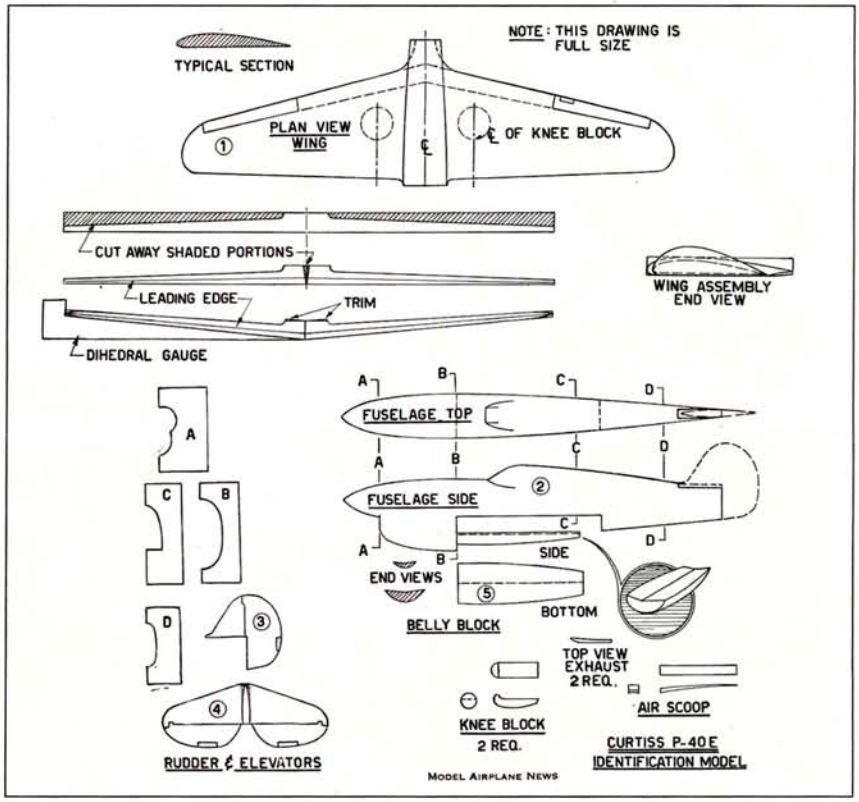
A feature story in *Model Airplane News*' May 1942 issue, "Modeling Planes For Uncle Sam," outlined a government-sponsored program designed to acquire 500,000 scale models of various Axis and Allied aircraft. The models were to be used to train airmen, gunners, spotters and other technicians in aircraft identification, range finding and tactical problems. For visual and practical purposes, all models were to be produced in $^{1}/_{72}$ scale, without landing gear, in a dull, black finish. Since all aircraft appear black at a distance, and they wanted to reduce any glare that might distort the silhouette image, that was the color selected.

One of the armed forces' biggest problems was training inexperienced people to recognize aircraft immediately. It was imperative that virtually instant decisions be made before "alerts" were called or aircraft were engaged. The models were needed, so a call went out.

As a teenager just entering high school with a penchant for building things, I signed up for what was then called "manual training." This was a woodworking shop that I somehow fitted in between academic studies. It was through these public education facilities that the government organized its program. It was in the public schools that the project directors were able to engage modelers in the effort. Modelers of that day were ideal producers, since all of us had carved solid models in our pursuit of boiling full-scale aircraft down to miniature size.

Modelers, students (who often became lifetime modelers) and teachers took to the project as "ducks to water." I personally acquired my knowledge of carving and shaping, with various tools and finishing paper, a three-dimensional form out of a block of wood in this program. White pine, ash, gum and poplar were used, because balsa was considered too soft for rough use. That material was also critical to war needs (life rafts, mostly) as all modelers were soon to learn.

Model Airplane News was the first to publish plans and directions for this program. The May issue featured the Curtis P-40E, and these features for the identification of planes became an ongoing series. Official drawings were also available from the Bureau of the Navy Department or each state Department of Education. In fact, many modeling companies jumped into the breach by providing kits and ma-



Model Airplane News was the first to publish plans and directions for models that would be used by the government for aircraft-recognition training.

Megow's Super Zomby—a SAM contest favorite—was advertised on our back cover 50 years ago.

terials at low cost to the modeling public for the program. Comet, Scientific and Modelcraft were among this helpful industry group.

I spent hours making these models, and became a fixture in the shop. I often fantasized that my model of a P-40 had trained a gunner *not* to shoot at a friendly aircraft returning to base in the Pacific. Perhaps, I'd muse, a life had been saved. Whether true or not, I felt I had done something; thousands of modelers felt the same!

The famed Leon Shulman released his soon to be legendary Super Zomby through Megow of Philadelphia. The unusual free-flight is still seen today at SAM contests, and it makes a most interesting soaring R/C aircraft. I had a Class C version on rudder/elevator R/C with a Webra .61 several years ago; it climbed like a rocket and would then soar around for extended periods. The Zomby Megow advertised was a 44-inch, Class A/B model for .19 to .29 engines. The airplane had no less than 21 wins in 1941 by fliers such as Shulman, Fran McElwee and Sal Taibi. And, it only cost a buck ninety-five. Times sure have changed!

About Those Engines

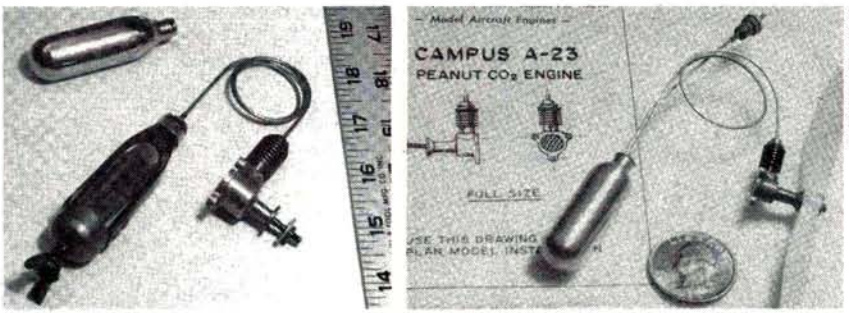
JOE WAGNER

CO_2 ENGINES, OLD AND NEW

WHAT'S THE difference between an engine and a motor? Some people claim that only an engine can produce power internally, whereas a motor merely converts into mechanical motion energy from some external source. In a technical sense, this is correct, but in common English, the two words are used almost interchangeably. We always say "steam engine," though its power comes from an external boiler/firebox. "Motorcycle," "outboard motor," "motor oil" and many similar terms have long been used to refer to internal combustion engines.

This month's column, however, is about motors—compressed gas motors, to be specific. Only two types of these have proven practical as model-airplane power sources: compressed air and CO_2. Air motors go back to the beginning of powered model flight, and many different types of these have been made since then, but they've never been truly popular with modelers. Their air tanks weigh too much; they take up a lot of space; and they can explode if they're over-pressurized.

Shortly after WW II, a new type of compressed gas motor appeared on the hobby market: the CO_2. Invented by Bill Brown (the same man who 13 years earlier had introduced the first really practical internal combustion model-airplane engine—the famous Brown Junior), CO_2 motors made power flying of miniature-sized models possible a full two years before the earliest $^1/_2$A engines appeared.



PHOTOS BY JOE WAGNER

Above left: Herkimer (OK Engines) marketed the first CO_2 motor. It didn't do well, however, because it was too heavy, and the prop was inefficient. Above right: the smallest practical model power plant, Bill Brown's Campus A-23 weighs just 7 grams, and this includes the tank, the fill fitting and a 4$^1/_4$-inch prop.

Like all good inventions, Bill Brown's CO_2 motor operates on a simple, easy-to-understand principle: pressurized CO_2 from a separate tank is connected to the motor's head via small-diameter tubing. The head contains a ball-check valve on its underside, which prevents the gas from escaping. Atop the motor's piston is a protruding pin, the "ball-bumper." As you flip a CO_2 motor's propeller, when its piston reaches the top of its stroke, the ball-bumper pops the check valve open and lets a burst of high-pressure CO_2 enter the cylinder, which pushes the piston down again.

This cycle repeats itself with each prop revolution until the CO_2 is used up. A fresh CO_2 charge generates approximately 800 psi of pressure. Expanding within the cylinder, this drives the piston to the bottom of its stroke, where exhaust ports, like those of a glow engine, let the spent gas escape. Since their 1947 introduction, quite a number of CO_2 motors have been manufactured in several countries, in various sizes, but Bill Brown's original operating principle has never been improved upon! Every commercial CO_2 motor made in the last 44 years has used Bill's system.

Bill Brown is still making CO_2 motors! In '47, he introduced his incredibly tiny Campus A-100 motor, with its bore and stroke of a mere $^1/_8$ inch. Today, he's manufacturing a highly improved version of the same motor, now called the Campus* A-23. Bill Brown's motors are, by far, the best quality CO_2's that I know of,

AIR POWER

The unique Z-Motor's only metal parts are its crankshaft and prop-driver. It turns a 7-inch prop and uses compressed air from a plastic soda bottle.

A brand-new compressed-air model-airplane motor from Italy offers a unique approach to this form of power. Made mostly out of plastic, the "Z-Motor"* runs from a 150psi (max) air supply in a 1-liter plastic pop bottle, which is inflated with a bike pump. "Fly with Free Fuel!" the makers advertise; and this little powerplant doesn't even need lubrication.

The Z-Motor's cylinder and case are transparent, clearly revealing the workings of its moving parts. These employ the "Bill Brown" system. One unusual feature: the piston and rod aren't connected! The ball-shaped upper end of the rod fits loosely within a conical cavity in the piston. When you turn the motor over by hand, the rod flops to and fro while the piston barely moves. When pressurized, the Z-Motor runs quite normally; the air pressure on the piston forces it and the rod tightly together.

Bert Pond imports the Z-Motor, and sells it in various combinations, ranging from an ARF airplane complete with motor and pump to the bare motor alone. Bert's mid-range no. 3 combination costs about $35 postpaid. It contains all the essentials a do-it-yourself modeler needs for "air power."

Several R/C airplanes are already flying with Z-Motors. My favorite is a beautiful Waterman "Aerobile" scale model designed and built by British master modeler Doug McHard. Needless to say, I've got an R/C project of my own under way for this unique powerplant!

QUESTIONS & ANSWERS

I always appreciate readers' input, and I respond to every letter I receive (please include an SASE, though). I do my very best to answer all the questions thoroughly and accurately— even if it takes several pages. Sometimes, the questions are of general interest and can be answered briefly; I'll respond to such queries in "Questions and Answers." Please send your model engine queries to me at 251 Danbury Rd., Wilton, CT 06897, not to the Mount Morris, IL, subscriber office!

Queries about old-time model engines keep coming in! It seems that many *Model Airplane News* readers still have motors they bought back in the good old days, and would like to fix them up again, either to fly with or just for display.

This pre-war Ohlsson .23 looks like new again, thanks to "Easy Way" spray paint. The prep work took time, but the results are worth it.

Max Hayes (Australia) and Don Knapp (Buffalo, NY) asked how to restore the black finish on old engine parts. There are three possibilities here: black oxide (for steel); black anodizing (for aluminum); or black enamel. All can be restored with little difficulty.

Taking black-enamel engine parts first, "crackle"-painted crankcases are easy to retouch with Ivory Black artists' acrylic. Clean the part with detergent and a toothbrush; then, using a small, stiff brush, apply the black acrylic paint just as it comes from the tube with an "impasto" technique to match the original wrinkled paint texture.

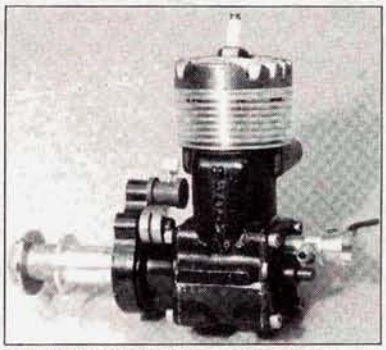
Black-enamel cylinders (e.g., Ohlssons) can be fixed up just like new, but all the original paint has to be removed first. That's a tedious job! The deep, narrow areas between the fins are most safely done with abrasive cord used like a shoeshine rag. After you're down to shiny bare metal, mask-off the crankcase, then re-paint with a spray can of "Easy Way" gloss-black engine enamel (available at K-Mart). I've found "Easy Way" the best product yet for this job, both in ease of application and in durability. It can stand 500 degrees Fahrenheit without harm.

Black-anodized engine parts, such as early McCoy crankcases, can also be restored with paint. To duplicate the appearance of the original finish (which was a type of inorganic dye), highly-thinned black enamel of the sort used for painting plastic models works well. Clean the surface thoroughly, then mop on the thinned paint wherever you need to re-blacken. Wipe the excess off after a minute or so, in the same way you would with wood stain. It takes some experimentation and patience, but you can return the old part to a "factory-new" appearance this way.

Now for black oxiding as used on the cylinders of Forster .29s, Atwood "Champions," McCoys of the late '50s, and screws, nuts, prop washers and needle-valve parts of many model engines. First, clean off all dirt and rust; a fine wire brush works well for this. You don't need to remove what remains of the original black finish. You *will* need a tin can (not a plastic container!) with enough 10W to 40W car engine oil in it to submerge whatever part you're about to re-blacken, plus a safe place to work. This job involves an open flame, very hot metal and burning oil: *be careful!*

Kustom Kraftmanship's reset tool for the Cox conrod in action. To prevent distortion, the piston head must be supported with a hard, flat, smooth surface.

Holding the part with a loosely wrapped steel wire "handle," heat it slowly and evenly with a small propane torch. Use the flame like an airbrush, to "paint" heat as uniformly as possible over the part. (This is easy for a propwasher, but requires time and patience for a deeply-finned engine cylinder.) Keep heating until the part becomes a uniform dark blue—the color of gunmetal.



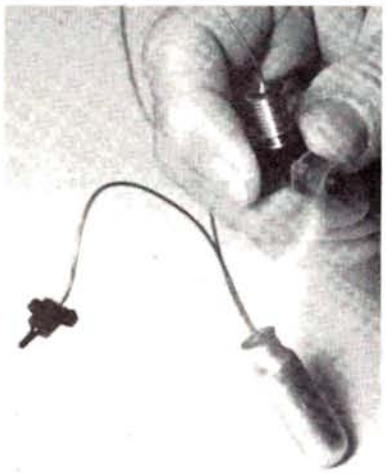
The black-anodized case of this McCoy .49 can be easily restored with thinned enamel.

Then quench the part quickly in the can of oil; pull it out within a second or two; and re-heat with the torch—evenly—until the part looks dry. The oil will flare and burn; that's normal. When the metal surface has no wet oil remaining, quench again. Repeat this procedure two or three times; then let the part air-cool. You're done!

Walt Janis writes from Jacksonville, "My TD .051 doesn't turn up like it used to, but I can't find anything wrong. It's never been crashed; yet the Tee Dee feels and sounds kind of funny when running—almost like there's something rattling around loose inside."

There probably *is* something loose inside: the conrod in its socket within the piston. This happens often enough with Cox engines that both Cox Hobbies* and Kustom Kraftsmanship* offer "Reset Tools" to fix this problem. These come in three sizes to fit .02s, .05s, and .09s. Complete instructions accompany the tools, but they don't tell you how hard you have to hit them to do the job.

I've found that several surprisingly hard raps with a medium-size ball-peen hammer were needed to re-set the loose Cox rod ends. I check the fit after each blow, of course, until the free play is just noticeable. Then the engine runs like new again, and generally never needs RE-re-setting.



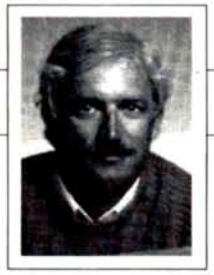
You can't do this with many model motors! A British Telco spins its 5½-inch prop. Although the Telco is no longer made, Bill Brown's far superior B-100 is now available.

with meticulously fitted, all-metal components. Other CO_2 makes (e.g., the British "Telco" and the Czech "Modela") have plastic pistons whose ball-bumpers gradually mushroom over in use, and this negatively affects power output. After heavy use, these motors will eventually refuse to run.

Most modelers wouldn't consider a power source as small as a CO_2 motor—particularly the Campus A-23—suitable for an R/C model. A few intrepid experimenters, however, have been flying CO_2 R/Cs for quite a few years with Modela motors and Cannon Super-Micro radios. Now I've received word about a new rudder-only proportional R/C system with a total airborne weight of 7 grams. That's less than the combined weight of a dime and a nickel! By the time you read this, I'll have one of my Campus A-23s powering a radio-controlled 16-inch Fokker D-7. Ready to fly, my little R/C Fokker will weigh less than an ounce!

**Here are the addresses of the companies mentioned in this article:*
Campus Motors, *sold by Peck Polymers, P.O. Box 710399, Santee, CA 92072.*
Z-Motor, *sold by Bert Pond, 128 Warren Terr., Longmeadow, MA 01106.*
Cox Hobbies Inc., *350 W. Rincon St., Corona, CA 91720.*
Kustom Kraftsmanship, *P.O. Box 3010, Fallbrook, CA 92028.* ■

AEROBATICS MADE EASY



DAVE PATRICK

HOW TO TRIM YOUR PLANE FOR OPTIMAL RUDDER RESPONSE

This month, I'd like to discuss the importance of rudder and some rudder-trimming techniques. As you develop your flying skills, you'll quickly discover how often you input rudder. No longer is rudder just used for taxiing! You'll need rudder for stall turns, knife-edge flight, point and slow rolls, etc. Later on, you'll find that to really perform precision aerobatics, you'll almost constantly have some rudder input in virtually all maneuvers.

Now that I've sold you on how important rudder is, it's also true we rarely get exactly what we ask for. Even the most highly developed aerobatic designs rarely give pure yaw when you input rudder. Generally, when you add rudder, you'll get some elevator or roll effect, or even both mixed in (these are called "cross control" effects). For example, if, in straight flight, you give right rudder, your plane may dive slightly and/or possibly roll slightly. Taking this further, if you're attempting a 4-point roll and you input rudder to hold the nose up at the first point, your plane may slightly roll and pitch as a result of the rudder input. When this happens, your plane will lose its heading and will want to roll out.

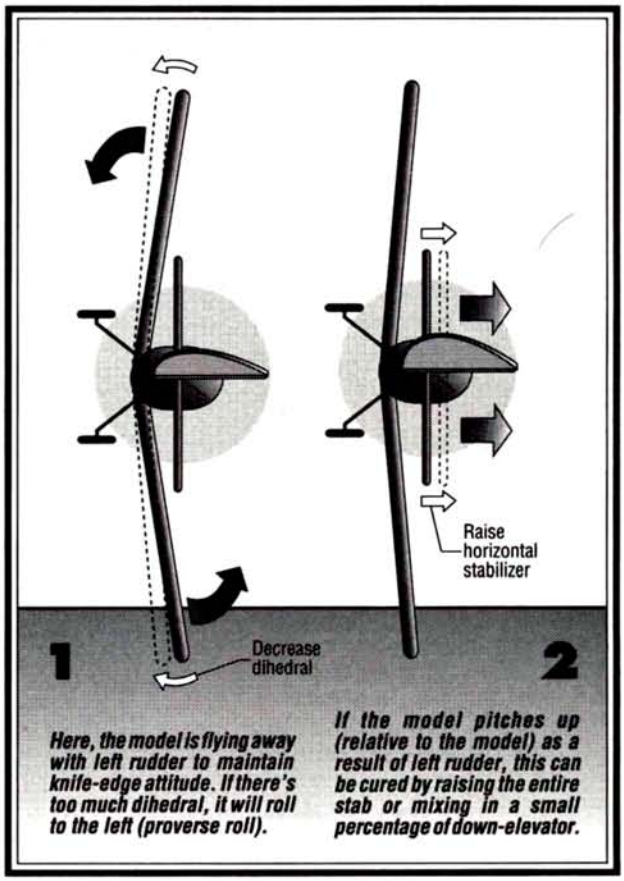
Fighting these unwanted tendencies makes precision flying much more difficult. One way to solve these problems is to mechanically adjust the angle or position of certain flying surfaces (I refer to this as an "aerodynamic" correction); the other is to use computer mixing to counteract the undesired flight characteristics.

First, let's deal with the pitching-with-rudder problem. Some planes pitch up with rudder input and some pitch down. Some even pitch up with rudder in one direction and then pitch down with rudder in the opposite direction!

Most of these problems can be aerodynamically corrected by raising or lowering the stab. If your plane pitches up with rudder, raise the stabilizer 1/8 to 1/4 inch. This can make quite a difference on some designs. Lower the stab if the plane pitches down.

If your plane pitches in different directions, that's a tough one. Some pilots twist their stabs to resolve this problem, but this opens up a whole can of worms. In any case, moving the stab up or down is the hard way to fix minor cross-control coupling. The easy way is to mix out these tendencies with your computer radio. (Notice I said minor; if these traits *aren't* minor, you probably aren't flying the right plane for really good aerobatics.)

The new computer radios can help you trim out a plane quickly. To set up your radio, first determine the direction of mix needed. For example, roll right to knife-edge attitude and use left rudder to keep the nose up. Make a mental note of which way the plane pitches and then land. Let's say it pitches down relative to the plane: mix left rudder (master) with up elevator (slave). Check the direction of the mixing! Then reduce this mix to about 4 percent, which is where you want to start. It takes a surprisingly small amount.



Here, the model is flying away with left rudder to maintain knife-edge attitude. If there's too much dihedral, it will roll to the left (proverse roll).

If the model pitches up (relative to the model) as a result of left rudder, this can be cured by raising the entire stab or mixing in a small percentage of down-elevator.

Carefully check all controls before flying again. Then test-fly and check the performance, and adjust the mixing as needed. Once you're satisfied with left rudder, then fly a right-rudder knife-edge and repeat the above procedure. Some radios give you the option of direction and amount of mix for either left or right rudder.

After you have your pitching with rudder resolved, we can work on fixing unwanted roll caused by rudder input. This can be fixed aerodynamically. For example, if your plane rolls "proversely," i.e., left rudder makes the plane roll to the left, you have too much dihedral. Adverse roll means too little dihedral.

On some foam wings, simply cutting the wing in half and changing the dihedral 1/8 inch at a time is the mechanical solution. Or again, get your computer radio out and mix in the appropriate opposite aileron to remedy the roll coupling. Mix rudder (master) to aileron (slave), and start with only about 3 or 4 percent. It's surprising how little it takes to correct.

Your plane is trimmed properly when you can roll to knife-edge and add top rudder, and it doesn't roll or change heading at all. Now you can input rudder at will, and you won't have to correct for undesirable side effects, making flying and aerobatics another step easier! ■

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING

SEND IN YOUR SNAPSHOTS

MAN is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1992. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to:
Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

TWO HOBBY CATS

Fourteen-year-old Matt Scherer of Cincinnati, OH, has seized the opportunity to show off four of his favorites. In his left hand is a Goldberg Gentle Lady; in his right, a Bee-Tween built from *Model Airplane News* plans. Also shown is an uncovered Ridge Runt, and let's not forget "Midnight"—Matt's faithful hobby cat. "For some reason, Midnight has an interest in what I'm doing," said Matt, "and he always seems to be around when I work on a plane." We hope lovable Midnight doesn't mistake any of your birds for Tweety Pie.

AQUA-CUB

Actually, this is a 1/4-scale model of the experimental Anderson Kingfisher. The model was built by Gordon Geren of Grove, OK, and like the full-scale version, it uses a standard J-3 Cub wing. The fuselage is built up out of balsa, plywood and fiberglass, and it has a Hobbypoxy finish. An O.S. 120 4-stroke pulls the 170-pound model aloft. Considering that he lives on a lake, Gordon should get fantastic mileage out of the tires!

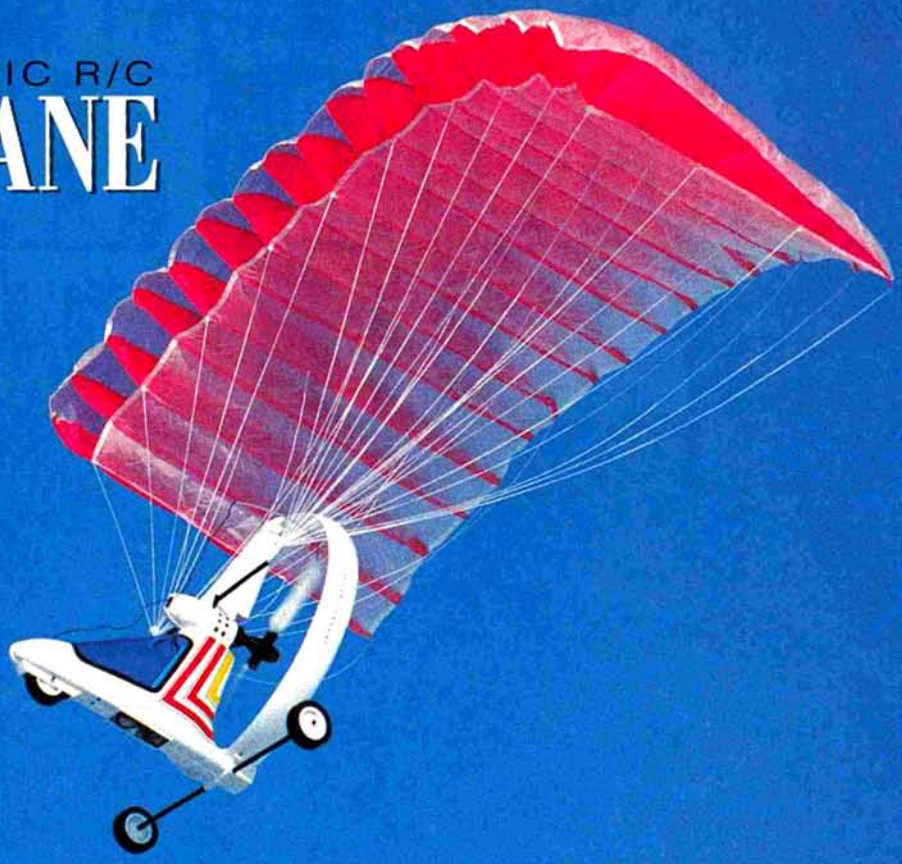
PRETTY UGLY

Jim Pintus of Broken Arrow, OK, writes, "If my entry is too ugly to print, put the photo of my project on the floor near a corner, and it will scare all the bugs and mice out of your building." Well, Jim, we think your 1935 Aeronca C-3 "Master" is quite adorable. The 23-pound, 120-inch-span C-3 is powered by an O.S. 1.60 4-stroke, and it has logged 47 flights to date. Jim's plane, which took three years to complete, has functional flying wires, stitched ribs, handmade operating cowl and doors, thousands of detail screws and three Best-In-Show wins. Ugly? We bet those bugs and mice would happily hop aboard for a ride!

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

ELECTRIC R/C

PARAPLANE SPORT



PHOTOS BY GERRY YARRISH & TOM ATWOOD

Author launches ParaPlane. The trick is to inflate the parachute by swinging the canopy from an inverted position until it's fully deployed above; power is applied, and you simply release the body with a slight forward push.

SIMPLY FUN

by TOM ATWOOD

ELECTRIC R/C Corp's* new ParaPlane Sport has an unusual quality that may be as unique as its appearance: it may well be the easiest-to-fly, commercially available outdoor R/C aircraft. Modeled after the full-scale ParaPlane concept (developed by the same designer), this 2-channel, powered parachute flies at approximately 15mph, whether climbing or descending. It's tough to crash, because with power off and controls abandoned, it simply floats down.

The full-scale ParaPlane is billed as one of the safest recreational flying vehicles on the market. You can purchase either of two models for under $9,000. Flight training takes around two hours; no license required.

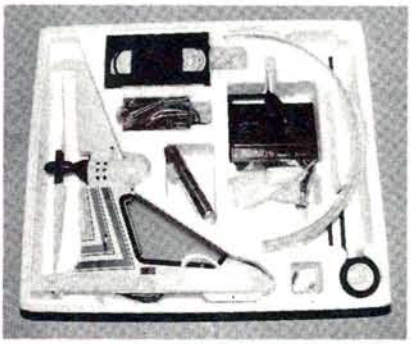
Since flight success is practically guaranteed, this craft could be a potential boon to novice R/C fliers. Once the ParaPlane has been mastered, the transition to a slow-flying trainer or powered glider will be more of a step than a leap. The ParaPlane kit won't require any careful selection of support equipment either. The pre-built kit comes packaged with 2-channel radio, an electronic speed controller, gear-reduction drive system, 7-cell battery and a peak-detector battery charger.

CONSTRUCTION

The ParaPlane is 99-percent assembled, and it's packed in Styrofoam. You'll need a regular screwdriver, a Phillips-head screwdriver, the included Allen wrench, and a 3/8-inch socket wrench or a pair of needle-nose pliers to assemble it in less than half an hour. A 35-page instruction book is well illustrated with photos and includes clear instructions for easy assembly and flight. A video also details the few steps necessary to attach the wheels, parasail control bar, prop shroud and parasail—and the techniques for launching and flying.

"It may have an improbable, even silly appearance, at first glance, but it's well-engineered and flies as advertised. It should whet the appetite of anybody who wishes to learn to fly an R/C aircraft with minimal fuss and effort."

As I built this unusual-looking aircraft, I was struck by the simplicity of its design and its solid, well-engineered components.



The ParaPlane comes complete with radio, battery and battery charger, 35-page instruction manual, video on assembly and flying, and all parts needed to complete the craft in less than half an hour.

The completed ParaPlane, ready to fly. The parachute is easily stored by rolling it inward from its outside panels and bundling it with a couple of rubber bands.

The battery is inserted into a hole in the rear of the "fuselage" and is held snugly in place by rubber pads that exert a friction-grip. The battery nests against stops that, from the outside of the body, look a bit like air scoops. The Hi-Tec radio and speed con-

SPECIFICATIONS

Type: Powered parasail
Parachute area: 11 square feet
Weight: 45 ounces
Canopy loading: 4.1 ounces per square foot
Power req'd: 19,000rpm DC 540 (i.e., .05) motor powered by a 7-cell Sanyo 1400mAh battery pack; 3.8:1 gear-reduction drive; speed controller includes a BEC and 3.5V auto-cutoff.
Length (power pod): 16 inches
Width (power pod): 18 inches
Height (power pod): 18 inches
Height (with wing inflated): 44 inches
Prop: 14x7 Aero-naut, which spins at 5,000rpm at full throttle
Parachute: high-performance, airfoil-shaped, ram-air canopy made of lightweight rip-stop nylon.
Power-pod construction: ABS plastic body with glass-filled landing-gear legs.
No. of channels req'd: 2 (throttle and "aileron")
Sug. price: $395 (Basic kit—without radio, battery and charger: $229.95)
Features: ball-bearing gearbox, variable-throttle electronic speed controller, 2-channel radio (aircraft- or ground-transmitter style), light foam wheels, glass-filled plastic gear legs, ABS plastic body, rip-stop nylon parachute, peak-detector battery charger and 7-cell Ni-Cd pack are included.

Hits

- The ParaPlane is arguably the easiest-to-fly outdoor R/C aircraft (on a calm day).
- It's a 99-percent pre-built, well-engineered model that can be flown within half an hour of opening the box.

Misses

- Proportional throttle on aircraft radio tested is spring-loaded (we would have preferred a non-centering throttle stick, but we realize this "off" centering feature was provided as a safety consideration).

QUICKEST SOLO

You've had your two hours of ground school briefing and preliminary flight instruction. Now you're ready to solo. The two engines start and the counter-rotating props begin to beat the air. The parachute, carefully folded and positioned on the ground behind you, begins to unfurl and fill with air. As it rises into the air, it will become a powered, ram-air wing.

As the Paraplane rolls forward, you concentrate on the flight controls: right pedal results in a right turn; left pedal results in a left turn; forward stick throttles-up the engine, causing the vehicle to climb; pulling the stick back reduces power for cruise; and pulling further back causes the vehicle to descend. The Paraplane will manage pitch and air speed for you (the speed range is 22 to 26mph)—all you need to do is decide whether to climb, cruise, or descend and steer.

If you need to make a power-off landing, you can use your steering pedals simultaneously just before touchdown to soften the landing. The preferred landing is with power on, which increases the glide ratio from a power-off 3:1 to an approach slope that's as flat as you'd like. Add throttle just before touchdown to create a flare, kill the engines, touch down and then apply both pedals to collapse the chute behind you. So much for the theory. Now that it's time to take off, you'll be airborne in only 100 to 250 feet, and in half that distance if there's a head wind. Want to give it a try? For more information, contact ParaPlane Corp.

FLIGHT PERFORMANCE

If the drive system "chatters" instead of "whirring" when you first throttle up, it's likely that the prop clutch is slipping. The clutch is a spring-loaded system that permits four nubs on the prop center plate to nest in four hollows in a matching gear-drive output plate. This safety feature disengages the spinning prop if it's obstructed. If the plate slips during powered flight, the ParaPlane won't have full power. This can be cured by slightly tightening the propeller hub nut.

- **Takeoff and landing**

When preparing to launch, hold the underside of the ParaPlane near the middle of the body. Inflate the parachute by swinging it from the ground up and over your head. Give the throttle full power as it approaches the top, and then release the craft into the wind. If you're facing into a mild wind of 5 to 6mph, it's easy to hold the ParaPlane over your head with the parachute fully deployed and the lines slightly tugging at the body. Full power is needed for a slow but fairly steep climb. The craft will cruise in level flight at about half power.

The paraplane in a landing approach. No need to flare!

We found that if the chute isn't fully deployed or is leaning heavily to one side at the moment of hand-launching (a pilot error that's easily avoided), the ParaPlane will swing to the side and may hit the ground hard as it tries to stabilize itself. We experienced one such "worst case" mishap on asphalt deck. The only damage was a broken prop and prop guard. Replacing these took a few minutes, and the craft was as good as new. ROGs are also possible from level ground into a slight head wind. The parachute must be positioned at the outset by hand.

Landings are automatic. Point the ParaPlane into the wind and reduce power for a flat landing approach. With power off, it floats down in a steeper slope and will bounce slightly as it hits the ground. The glass-filled landing-gear legs flex to absorb the loads caused by a steeper descent.

The ParaPlane's throttle is spring-loaded, so constant pressure on the throttle stick is necessary to control ascent and descent rates. (We missed the non-centering throttle stick to which we're accustomed; the spring-loaded stick is a safety consideration, given the absence of an arming switch.)

- **High-speed performance**

There's no high-speed flight per se, because the plane always flies at about 15mph. How does this happen? As forward thrust is applied, the pod moves forward relative to the parachute, and the chute's angle of attack increases. The component of lift that's directed rearward as a result of the increased angle of attack (induced drag) counteracts the additional forward force, so there's no gain in air speed. As angle of attack increases, however, the lift coefficient increases, so the addition of throttle causes the vehicle to climb.

- **Low-speed performance**

When it seems that the parachute is about to stall (e.g., a gust of wind has suddenly slowed forward flight, and the craft has pitched up slightly with a higher angle of attack), recovery is instantaneous. Instead of dropping or "mushing" forward as a fixed-wing plane would, the Paraplane momentarily hangs in the air and then either settles into a slow, forward, power-off descent or, if power is added, continues forward in cruising flight as if nothing happened.

When flying dead-stick, there's noticeably less "aileron" control than in powered flight. In a power-off descent from about 300 feet in a about a 5mph wind, full left turn resulted in a turn radius of over 50 feet. With power on, a spiral descent can be achieved with a much tighter turn radius of about 15 to 20 feet, and if power is then turned off, this tighter spiral descent will continue as long as full turn is applied.

- **Aerobatics**

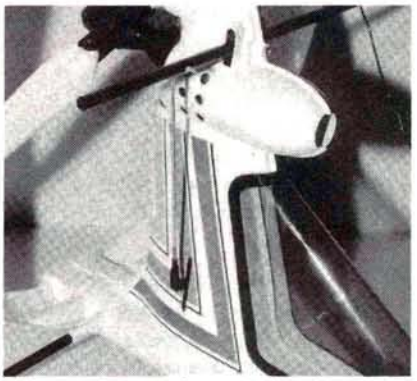
Although you can't loop or roll the Paraplane, it's easy to maneuver; you can turn and weave back and forth in typical parachute fashion. Slight acceleration is noticeable as turns are entered, and the slightly increased rate of descent in a turn requires the addition of a little power to maintain altitude. The Paraplane would make a reasonable entry-level R/C contest ship, given the finesse required to guide the vehicle around through a predetermined course at very low altitude. The Paraplane can be flown in a comparatively small field, e.g., baseball-diamond size. Making tight turns in close quarters was challenging, even for experienced R/C fliers.

When flying into the wind, turning power off will result in a fairly steep descent. A powered upwind descent can be steepened by pulling back to half throttle and gently weaving back and forth. Higher winds approaching 10 to 12mph definitely increases the required piloting skill.

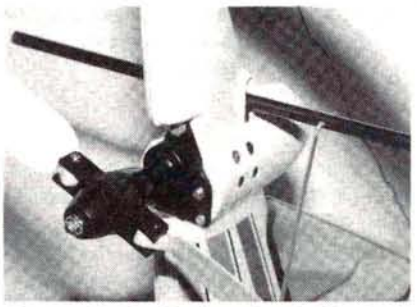
In mild wind conditions, flying times averaged 4.5 minutes using seven Sanyo 1400mAh SCR cells, and 5.5 minutes using seven Panasonic 1700mAh SCR cells.

troller are pre-mounted on Velcro® strips. The 14x7 plastic propeller is pre-mounted and the clutch assembly pre-adjusted.

The ParaPlane uses a 2-channel, 27MHz radio and can be purchased with either a pistol-grip radio or a stick radio (both on legal aircraft frequencies). This means that many R/C car buffs will find the transition to Paraplane flight a simple process indeed.



The parachute steering-control arm is actuated by a single servo that's nested in the body behind the cockpit canopy.



A gear-reduction drive is equipped with a clutch system that disengages the propeller from the drive train if the spinning prop is obstructed.

CONCLUSION

How to sum up this craft? It may have an improbable, even silly appearance, at first glance, but it's well-engineered and flies as advertised. It should whet the appetite of anybody who wishes to learn to fly an R/ C aircraft with minimal fuss and effort. Skill is required to fly the ParaPlane nimbly through a predetermined, low-altitude course. On the other hand, if the beginner encounters difficulty, the parachute's already deployed! Our flight tests proved flying this model can be fun for modelers of all skill levels.

**Here's the address of the company featured in this article:*

***Electric R/C Corp.**, 5801 Magnolia Ave., Dept. MN, Pennsauken, NJ 08109; (609) 663-2234.*

***ParaPlane Corp.** (address above).* ■

SMALL STEPS

RANDY RANDOLPH

"ONE OF THESE DAYS" PLANES

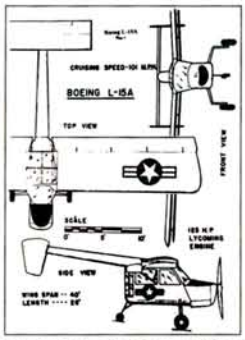
ONE OF THE most neglected airplanes by the scale people is the Goodyear inflatable airplane, which was developed back in the early '50s. It was a subject in one of the "Wings" programs on The Discovery Channel a while back. Goodyear developed a single-place airplane that, when deflated, would fit into a wheelbarrow and could be inflated from a compressed-gas bottle and ready to fly in less than 10 minutes.

The special, internally braced, inflatable material that Goodyear developed would be very difficult to duplicate for a model; but who said the model would have to deflate and fit into a scale wheelbarrow? One thing, the self-contained tank on the Cox* .049 makes it a natural for the project. Wonder who'll be the first?

And, while we're on the subject of scale airplanes, the Boeing L-15 would make a good schoolyard-scale subject. The size of the original aircraft is just right for a 1-inch-to-the-foot reproduction with a TD or G-Mark up front. The flap arrangement should provide a very slow and easy airplane. It would be a good idea to add it to the "one of these days" list.

Cox .02-powered Tupenny flown by Gene Hempel, AMA District VIII vice president.

It's always nice to have friends in high places. The picture of Gene Hempel, AMA District VIII vice president, shows him flying a .02-powered single-channel airplane during the Dallas Small Steps Fly-In last fall. It's nice to know that someone on the AMA council believes in fiscal responsibility and enjoys the simple and inexpensive.



The Boeing L-15 would be a great 1-inch-to-the-foot subject for schoolyard-scale devotees.

Gene's airplane is guided by the new Cox Failsafe single-channel radio, which is one of the new lightweight systems that are starting to show up. Cannon* is supposed to have a 2-channel extra-light system available soon that could make indoor electric R/C practical.

Along that line, Gary Reese, of Marion, IN, sent along a dandy geared electric motor that's available as a replacement part (no. 90012-0700) for the Tyco* 2800 Jet Stream. The motor system turns a 6-inch prop, of about 8-inch pitch, at a respectable 4,000rpm using a 4-cell, 225mAh receiver battery. The motor draws about 2.5 amps at 4.8 volts, so a single charge should fly the airplane and the radio system for about 3 or 4 minutes. With a motor-battery-radio weight of 4 ounces, and allowing an additional 2 ounces for the airframe, it should be possible to build an airplane of about 30-inch span that could fly in a school gym! Son of a gun, there's another project for the OOTD list!

If you want to live a long, long time, build and fly small airplanes. There are just so many things out there that are crying to be done that it doesn't look as if there's nearly enough time in the average lifetime. Who could quit when there's so much fun and stuff yet to be done...?

Talking about fun, this year, the Small Steps II Fly-In—held annually in Little Rock, AR—will be a three-day event from July 10 through the 12. If you haven't attended one of these fly-ins, you've missed one of the truly fun weekends of the year. What the Flying Aces Club is to free-flight scale, the Little Rock fly-in is to radio control. If you have an airplane powered by anything from a housefly up to a .26 glow engine, come and fly. Joe Wagner and I will be there, you can bet on that!

**Here are the addresses of the companies mentioned in this article:*
Cox Hobbies, *350 W. Rincon St., Corona, CA 91720.*
Cannon R/C Systems, *2828 Cochran St., Simi Valley, CA 93065.*
Tyco Toys, *Customer Service Dept., 540 Glen, Morristown, NJ 08057.*
Royal Products, *790 W. Tennessee Ave., Denver, CO 80223.* ■

CHEAP-MUNK?

The low cost per hour of flying small airplanes has always been recognized, and the newest entry in the field is Royal's* Chipmunk .25. It features improved prefabrication methods, with pre-cut fin and elevator exit slots as well as pre-installed control horns, wing dowels and pushrods.

The factory-finished modular sections provide economy of assembly time along with low maintenance cost. All necessary hardware, including wheels, tank, pushrod connectors and spinner are provided, and the surfaces are pre-hinged.

With a span of nearly 50 inches, it should be suitable for hot .10s to 4-stroke .20 to .26s.

The new Sanyo 1700mAh SCRC cell.

NEW BATTERIES for ELECTRIC •FLIGHT•

by TOM ATWOOD

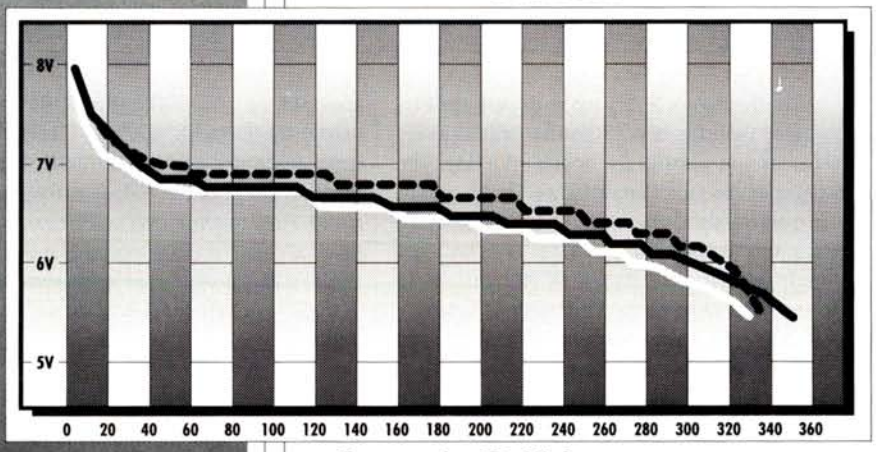
We test Trinity's new cells

THOSE OF US who tinker in the electric-flight area are always on the watch for advances in battery performance. We recently received review samples of two new types of 1700mAh SCR Ni-Cd cell from Trinity*, a leading supplier of batteries and motors in the R/C car world. Trinity is apparently one of the first to carry these new cells. One type of cell is the Panasonic P-170 SCR, and the other is the Sanyo SCRC. Both are sub-C cells. The Panasonic cells were "pushed," meaning they had been rigorously cycled and selected as top performers. We could hardly wait to test the new cells.

A Panasonic P-170 7-cell pack with an Astro Flight connector. These are "pushed" 1700mAh SCR cells, i.e., Trinity has cycled, selected and matched them for top performance.

Most electric-flight modelers are familiar with Sanyo 1400mAh SCR and 1700mAh SCE cells, which are also sub-C size cells. SCRs are favored because of their low internal resistance, which translates to a higher discharge rate and higher average per-cell voltage. The SCEs offer approximately 18 percent greater capacity, but because of their greater internal resistance and lower average per-cell voltage, there's a tradeoff: you get longer duration with slightly less power. Moreover, the performance of SCE cells will drop off if you cycle them more than twice in one day. Because of their greater internal resistance, they tend to overheat more quickly when run hard, and when they do, performance also slackens. SCRs can be cycled several times in a day without degrading performance.

Now enter the new 1700s. We compared the performance of the new bat-



This chart shows the discharge curves at a rate of 20A for Sanyo SCRC, Sanyo SCE and Panasonic P-170 1700mAh, 6-cell packs.

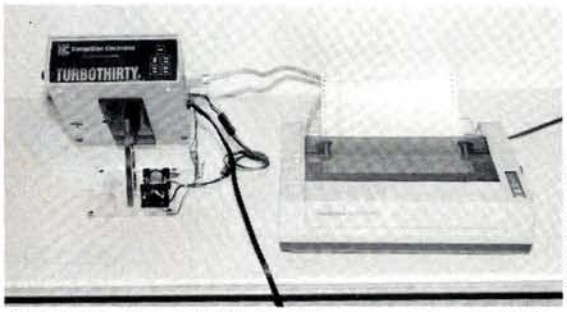
NEW BATTERIES FOR ELECTRIC FLIGHT

teries with that of some high-performance Sanyo 1400mAh SCRs and SCEs. We used two pieces of equipment—a Victor Engineering* Hi-IQ, and Competition Electronics* Turbo-Thirty* (shown). These tests reflect a very small sample, and we can only report what we found, but the results are interesting. Tests were performed after six charge-discharge cycles on new batteries (see charts).

On the Hi-IQ, I also looked at the total mAh capacity of the Panasonic SCR cells. Interestingly, the Hi-IQ showed that the Panasonic cells provided over 1900mAh of juice at a 15A discharge rate and about 1800mAh at a 20A rate. The run time at a 15A discharge rate also averaged between 7 and 8 minutes. This suggests that for models with lower power consumption, i.e., in the 15A range, the Panasonics may be unbeatable for duration. The Sanyo 1700mAh SCRs appear to have higher total power output and provide almost the same duration.

new Sanyo SCRCs as of the press deadline, but the test data indicates their performance should be impressive.

The new 1700 SCRs appear to be an improvement over the existing SCEs. They can be recycled several times a day, and they offer as good as or better discharge rates for better performance in the air. They appear to be the best choice for electric fliers who want to maximize cruise time. Because the average voltage of the Panasonic cells is lower than that of the current



PHOTOS BY TOM ATWOOD

Competition Electronics' Turbo-Thirty was used for most of the bench tests. Cells were discharged to .9V per cell.

TURBO-THIRTY DISCHARGE TEST

	Avg. Cell Voltage	Discharge Time
5A charge, 20A discharge:		
Panasonic SCR 1700mAh, 6 cells	1.10	5 min., 50 sec.
Sanyo SCR 1400mAh, 6 cells	1.13	4 min., 37 sec.
Sanyo SCRC 1700mAh, 6 cells	1.13	5 min., 38 sec.
Sanyo SCE 1700mAh, 6 cells	1.09	5 min., 32 sec.
4A charge, 15A discharge:		
Panasonic SCR 1700mAh, 6 cells	1.11	7 min., 33 sec.
Sanyo SCR 1400mAh, 6 cells	1.13	6 min., 10 sec.
Sanyo SCRC 1700mAh, 6 cells	1.17	7 min., 19 sec.
Sanyo SCE 1700mAh, 6 cells	1.13	7 min., 18 sec.

Like the Sanyo SCRs we're accustomed to, you can cycle the new 1700mAh cells as many times as you want in the course of a day. The weight of the new Panasonic cell is 49 grams, compared with 52 grams for the 1400mAh SCR. Thus, in a 7-cell pack, you save 3/4 ounce. The weight of the new Sanyo SCRC cell is 53 grams—the same as the 1700mAh SCE cell.

For a flight-test comparison of the Panasonic Ni-Cds with the standard Sanyo 1400mAh SCRs, I chose the relatively "draggy" ParaPlane Sport. With a 7-cell pack of standard SCRs, flights averaged more than 4.5 minutes, and with a 7-cell pack of the Panasonics, 5.5 minutes. The ParaPlane climbed slightly faster with the 1400mAh SCRs. We hadn't flight-tested the standard, i.e., the 1400mAh SCRs (or for that matter, the 900mAh "cut" sub-C cells, not tested here), these new entries seem unlikely to replace the SCR cells now in wide use. But the SCRC's could. How much power can be extracted from the new cells for a high-speed climb to altitude? We're still testing. As we gain more experience in flight tests of these new cells, we'll report our findings.

**Here are the addresses of the companies mentioned in this article:*
Trinity Products, Inc., *1901 E. Linden Ave., #8, Linden, NJ 07036; (908) 862-1705, Fax (908) 862-6875.*
Victor Engineering, *380 Camino de Estrella, Ste. 170, San Clemente, CA 92672; (714) 496-9701.*
Competition Electronics, *Inc., 3469 Precision Dr., Rockford, IL 61109; (815) 874-8001.*

1st Prize $1200

Jeffrey Holan's Stealth-E (first-prize winner) is an electric ducted fan that was developed following his successful experimentation with electrifying the Model Airplane News fantrainer design. It uses an 05 racing motor and two 5x3.5 pusher props cut down to 3 13/16 inches. (They're mounted at 0 degrees incidence for a slotted effect.) The Stealth-E weighs 39.9 ounces, and it has a wingspan of 36 inches.

2nd Prize $900

Michael Van Staagen's Micro Jet II (second-prize winner) was designed as the smallest possible model using standard radio gear. Two ounces of fuel provide 12-minute flights. Weighing in at just over 1 pound, it has a wingspan of only 18 inches. It provides jet looks and performance on "the tightest of budgets."

3rd Prize $750

Al Masters' 1/10-scale Dornier 335 (third-prize winner) weighs 9 pounds, has a wingspan of 56 inches and was designed from drawings and photos received directly from Dornier. This scale tour de force uses Spring Air retracts and flaps, as well as two .25-size engines in a push/pull configuration. Torque-cancelling thrust provides smooth climb-outs!

4th Prize $500

John Kidd's A-10 Sport-Scale (fourth-prize winner) is powered by two Tee Dee .51s housed in 2-liter soda-bottle sections. This inexpensive Warthog, with a single fuel tank, flies well on two channels: aileron and elevator. It weighs 2 pounds, 2 ounces, and it has a 56-inch wingspan.

Richard Engel's Winglet (left), which tied for fifth place, is an aerobatic, pusher K&B .40-powered flying wing with split drag-control surfaces, steerable nose gear, and removable nose piece, canopy and servo access panels. Its wingspan is 74 inches.

5th Prize(tie) $125

Stan Rutz's .15-powered Supercake (above), which tied for fifth place, has a wingspan of 72 inches and weighs 3 pounds, 8 ounces. Stan said he wanted to create a design that would be "slippery enough to handle wind, able to take off any place, climb like a rocket, land like a parachute, thermal, slope soar, and be easy for a first-timer to build," among other things!

THE 2ND GREAT R/C DESIGN CONTEST WINNERS

OUR CONGRATULATIONS to the winners of the 2nd Great R/C Design Contest! From the remarkable mix of superb models featured in our January issue, we've picked winners in five categories. Our readers provided key assistance in this daunting task.

After compiling the nearly 600 ballots received into a computerized database, we found that there were nearly as many preferences among our readership as there were designs! Of the 45 finalists, all but four received at least one vote for first place; all but one received a second-place vote; and all received at least one vote for third, fourth and fifth places.

A review of the tabulated votes did show, however, that a handful of designs were clearly the most popular. To better assess the results, we weighted the votes to favor designs that received a higher placement (e.g., a first-place vote was given 5 points; a second-place vote, 4 points; a third-place vote, 3 points, etc.). The resulting weighted scores confirmed the initial picks generated from the raw data.

Although the winners were clear favorites, they didn't achieve a landslide victory (the six winning designs represent 13 percent of the entries, 31 percent of all votes, and 35 percent of the total of weighted scores). For our part, we were surprised that the most popular designs were smaller models (does this bespeak a trend?) and that no biplanes made it to the winners' circle.

Given the variety of great designs and the broad reader response to so many of them, we plan to bring you both the winners and many of the other finalist designs in the form of detailed construction articles. We offer our thanks to all who helped make this contest a success and to the winners listed here! ■

MODEL AIRPLANE CONSTRUCTION NEWS MAGAZINE

1/12-SCALE

P-51 MUSTANG AND Bf-109

by TOM STRYKER

ADDING TO SOME of the classic confrontations of all times (Ali and Frazier, Roadrunner and Coyote, Donald and Ivana), here are two of the most famous aerial adversaries of WW II: the North American P-51 and the Messerschmitt Bf-109.

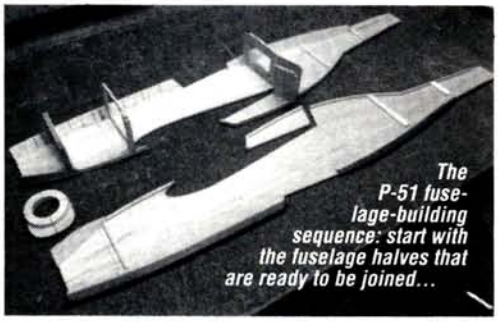
Modeled to 1 inch equals 1 foot, these aircraft were designed to compete in the new AMA-sanctioned combat event—1/12-Scale WW II Combat (see sidebar). Though the P-51 is almost exactly 1/12 scale (37 1/4-inch span), the Bf-109 in 1/12 scale came out ridiculously small (32 1/2-inch span), so the 5-percent-deviation rule was followed to increase its span to a more reasonable 34 inches, and the stab and fin to a size

PHOTOS BY TOM STRYKER

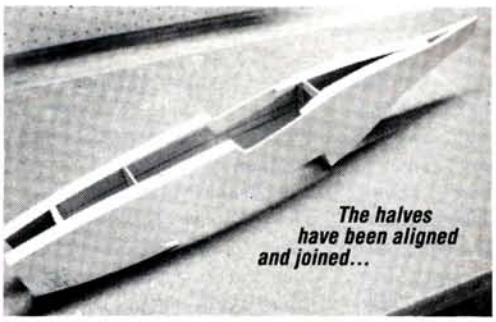
P-51 MUSTANG AND Bf-109

large enough to avoid them being mistaken for scrap balsa! Since the planes are designed for combat, their design and finish are as simple as possible. Murphy's law says "He who spends the most time building will be the first to midair!" (or something like that!).

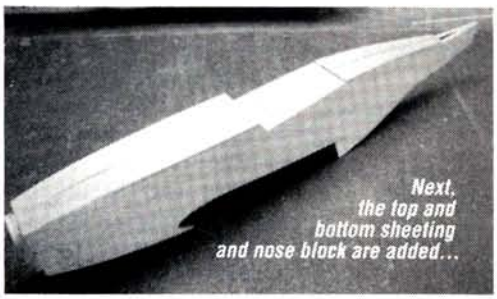
Almost identical building techniques are used for both models, so putting them together in one article was a cinch. The wings are fully symmetrical and build up very light. The fuselages use simple "box-type" construction with a little triangle stock for shaping the tops. There's no landing gear, so hand-launching is used. The radio required is 3-channel (no rudder) with mini-servos and battery.



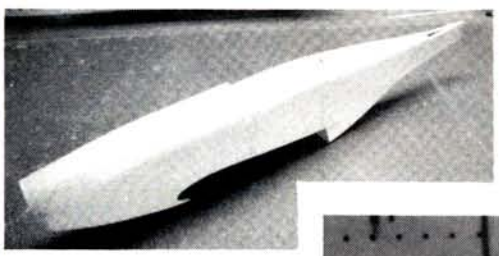
The P-51 fuselage-building sequence: start with the fuselage halves that are ready to be joined...

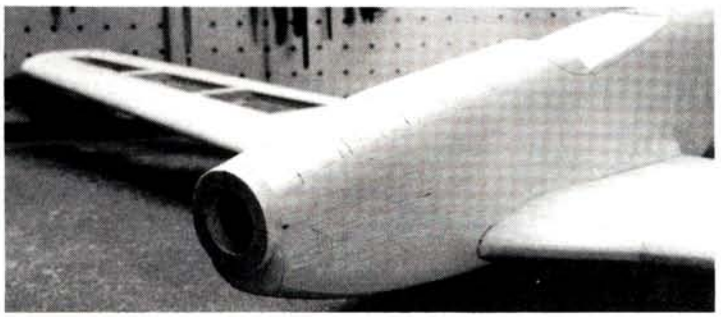


The halves have been aligned and joined...



Next, the top and bottom sheeting and nose block are added...





Above: after a little carving and sanding, the shape is nicely rounded.

Right: a view of the P-51's nose area after the shaping has been completed.

SPECIFICATIONS

	P-51	Bf-109
Scale	1/12	1/12 (plus 5 percent)
Wingspan	37 1/4 inches	34 inches
Length	32 3/8 inches	30 inches
Wing area	240 sq.ins.	205 sq.ins.
Weight	1.75 to 2.2 pounds	1.6 to 2.2 pounds
Wing loading (oz/sq. ft.)	17 to 21	18 to 24
Engine	10 to .15 (no tuned pipe)	
No. of channels	3 (aileron, elevator, throttle)	

(Miniservos and battery required)

CONSTRUCTION

Because of the size and limited wing area of these models, careful selection of balsa is a *must*. Use very light wood for the wing and fuselage and just slightly heavier wood for the tail.

Since the two models are built so similarly, all instructions, except where noted, apply to both aircraft.

• **Wing.** The wing is easy to build since, although it's fully symmetrical, it's built on a flat surface. The plans only show one wing half, so two identical wing halves are built over one drawing.

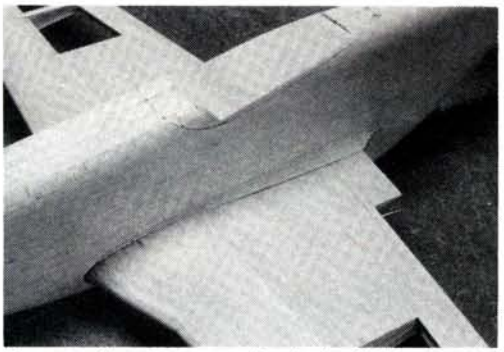
Begin by cutting the 22-degree angles into the 3/16x3/8-inch leading-edge stock. Pin the leading edge (cut slightly oversize), trailing edge, 1 1/4-inch aileron stock, capstrips and center-section sheeting to the plans. Do *not* cut out the 1-inch-wide ailerons yet. Secure the bottom spar and all the ribs. Attach the top spar and leading edge to the ribs. (Note: since the inner two ribs on the P-51 are longer, cut the leading edge where it meets R-3, sand the appropriate angle, and reattach.)

Put 1/16-inch shear webs between all the ribs, securing them to the two spars. Secure the top trailing edge and leading edge and the top center sheeting. Then add the top capstrips to the ribs.

Remove the wing from the building board, and secure the bottom sheeting to the ribs and leading edge. Trim and round off the leading edge. Build the other wing half, making it identical to the first. Note that the ailerons haven't yet been cut out.

Block-sand both ends of the wing half. Roughly carve and attach the wing tips. Do *not* allow the glue to come into contact with the rear 1 inch of the aileron stock (since it will be cut out next). Round off and final-sand the tips.

With a long straightedge and an X-Acto blade, cut out the 1-inch-wide ailerons from the wing center section to the wing tip. Saw the ailerons away from the center-section trailing edge. Hollow out the center sections as necessary, and insert the 1/16-inch aileron torque rods; then reattach the



For cosmetic reasons, an optional wing fillet made out of scrap 1/2-inch triangle stock was added.

center-section trailing edges. Bevel a vee-shape into the leading edge of each aileron.

Prepare the wing dihedral guide by cutting it out of scrap 1 1/4-inch aileron stock and scrap 1/16-inch sheet. Cut a 3/16-inch slot in the front. Attach the dihedral brace to one wing half, then attach the other wing half, being very careful to ensure that the wings are aligned. The dihedral brace should provide the required 10 degrees of dihedral, but double-check with about 3 3/4 inches under one tip. Cut and/or sand straight across the center leading and trailing edges as depicted on the plans. Add scrap 1/16-inch balsa as necessary to the leading edge. Wrap the center section with 2 1/2-inch nylon reinforcing cloth and secure it with thin CA. Insert the 3/16-inch dowel.

• **Fuselage.** Cut out the fuselage sides and bulkheads. Drill holes in the firewall for the engine-mounting bolts, the fuel line and the throttle linkage; their positions will depend on how you want to position the engine.

Attach all stringers, rear doublers, braces and triangle stock (with relief cuts, as appropriate) to both fuselage sides. Do *not* add the 1/16-inch wing-saddle doubler yet, because that would make it difficult to bend the fuselage sides together. Block-sand the inside rear of the fuselage sides so that they'll fit flush together when the fuselage is joined.

Cut out the 3/16-inch nose-block pieces (two for the P-51; three for the Bf-109), and glue them together.

Tack-glue the firewall and bulkheads to one fuselage side so that you can reposition them when you join the fuselage halves. Join the fuselage halves at the rear, then work forward, tack-gluing each bulkhead. Use a jig to ensure alignment, make corrections as necessary, then apply CA to secure the bulkheads firmly.

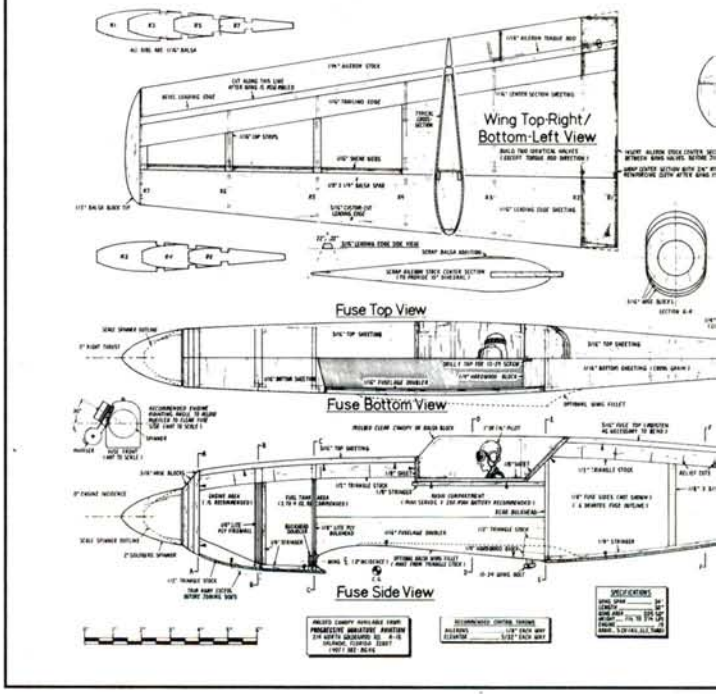
Wet the top surface of the 3/16-inch top sheeting as necessary to bend it around the fuselage, then attach both pieces to the top of the fuselage. Trim and attach the 1/8-inch cockpit floor pieces. Invert the fuselage and add the 1/16-inch cross-grain bottom sheeting. Block-sand the nose area and attach the nose block. Attach the 1/16-inch fuselage doublers to the inside walls of the fuselage, and trim them flush with the wing saddle.

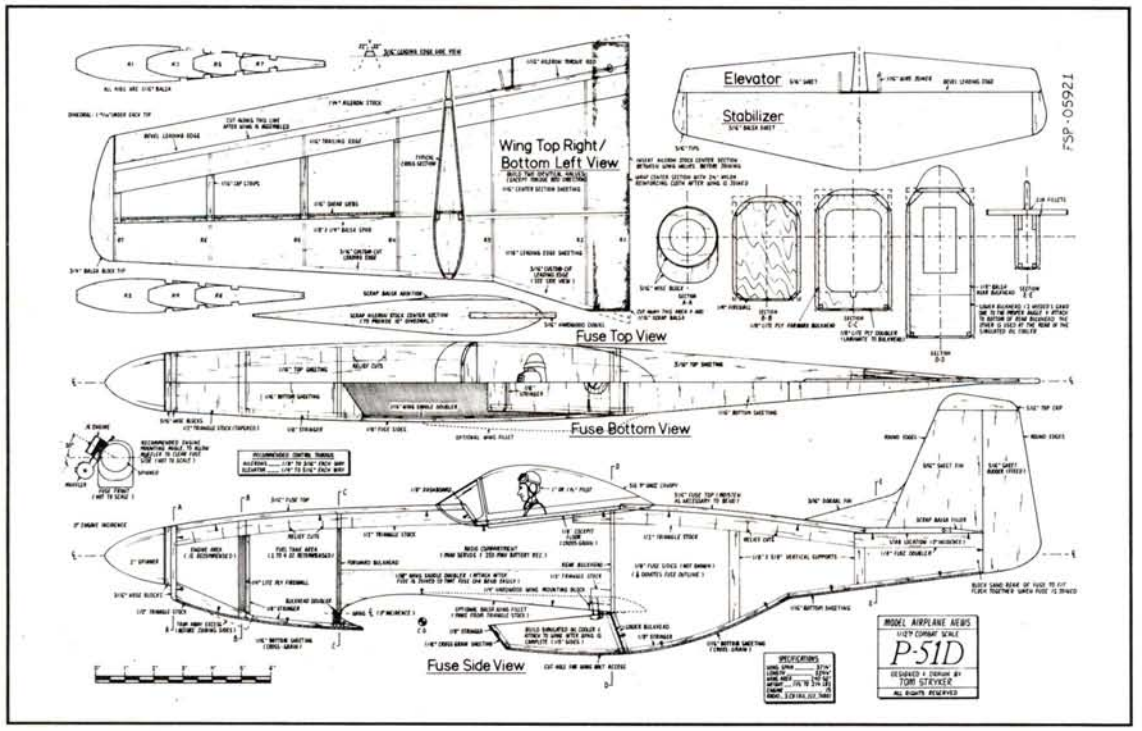
Carve and round off the entire fuselage and nose section, referring to the cross-sections on the plans. A typical sequence would be to carve the entire fuselage roughly with an X-Acto blade, sand the corners with 80- to 100-grit sandpaper, then smooth the surface with 240- to 320-grit sandpaper.

• **Tail assembly.** After cutting out the 3/16-inch fin and stabilizer parts, glue them together and round off the edges slightly. Bevel a vee-shape into the leading edge of the elevators, and taper the trailing edges slightly. Bend the 1/16-inch connecting wire, and drill appropriate holes in the elevators. Groove out the trailing edge of the stabilizer enough to accept the wire.

• **Wing mounting.** Mount

ORDER THE FULL-SIZE PLANS...





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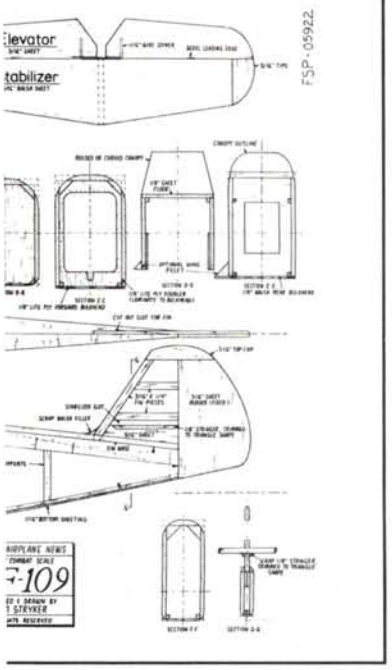


the 1/4-inch hardwood wing-bolt block, and affix the 1/2-inch triangle-stock pieces securely in the corners. Trial-fit the wing, and open up the slot in the bulkhead as necessary until the wing fits snugly in the saddle. Align the wing then drill a 5/32-inch hole through the wing rear and follow it with a 10-24 tap. Remove the wing, and enlarge the hole in it just enough for a 10-24 nylon bolt to fit easily.

- **Oil-cooler assembly (P-51 only).** With the wing mounted, trim and assemble the pieces for the simulated oil cooler and glue them to the wing. Mount a scrap piece of 1/8-inch stringer across the front corner, then sheet the front and top with 1/16-inch cross-grain balsa. Round off the edges to match the bottom of the fuselage, and make a 1/2-inch-diameter hole above the wing bolt to allow access.
- **Tail mounting (P-51 only).** Align the stabilizer with the wing, then secure the stab to the fuselage with plenty of medium CA. Mount the fin assembly to the top of the stab and the rear of the fuselage. Add a small scrap of balsa to the junction behind the stab where the fin meets the fuselage top, and sand to shape.
- **Tail mounting (Bf-109 only).** Slide the stab through the slot in the fin, and secure it with thin CA. Carve two pieces of scrap 1/8-inch stringer into a triangular shape, and glue them securely to the junction on the bottom of the stab where it meets the fin. Secure the fin to the top of the fuselage (fit it into the slot in the top sheeting; see plans) and to the rear of the fuselage.
- **Canopy.** The P-51 has a standard Sig* 9-inch WW II canopy, which should now be cut out and trimmed. For the Bf-109, carve one out of balsa, vacu-form one, or order one from Progressive Miniature Aviation*.
- **Wing fillet (optional).** For a little cosmetic improvement, a fillet may be added to the joint between the wing and fuselage. Trim scrap 1/2-inch triangle stock to the approximate shape of the wing saddle. Make relief cuts as necessary to bend the triangle stock around the fuselage, and secure the fillet to the fuselage. The exact shape of the fillet isn't critical, so you may sand until you like the way it looks.

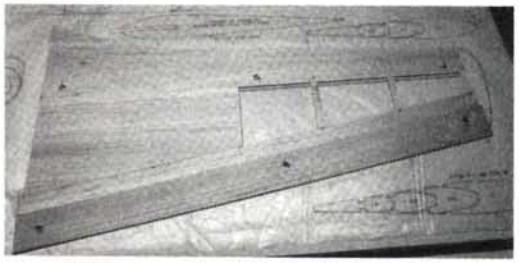
COVERING

Cut the cowl opening for your engine in the appropriate position. Cover the aircraft with your favorite iron-on film. Pick a scheme that will show up well in the air and that has sufficient contrast between the top and bottom. Fuelproof all the exposed areas after you've completed the covering. Insert a pilot figure, if you want one, and attach the canopy.

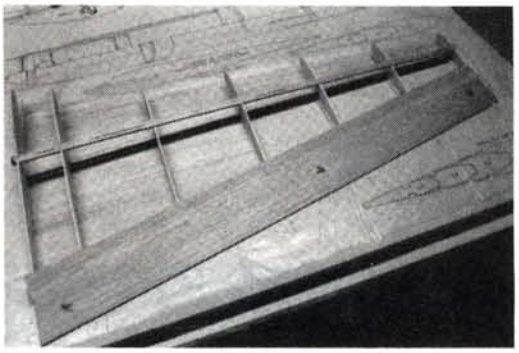
EQUIPMENT INSTALLATION

Begin by installing the engine and fuel tank (2- to 4-ounce tank) so that the radio may be positioned to adjust the CG. The radio will probably have to be positioned as far rearward as possible to offset the long nose moment. Stick with the recommended control

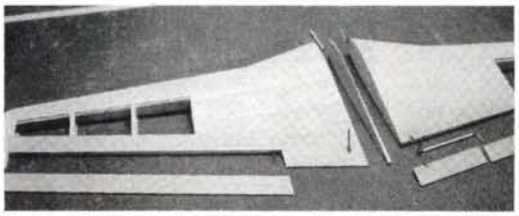
P-51 MUSTANG AND Bf-109



Although fully symmetrical, the wing is built on a flat surface. Here, the bottom sheeting has been pinned to the plans over wax paper.

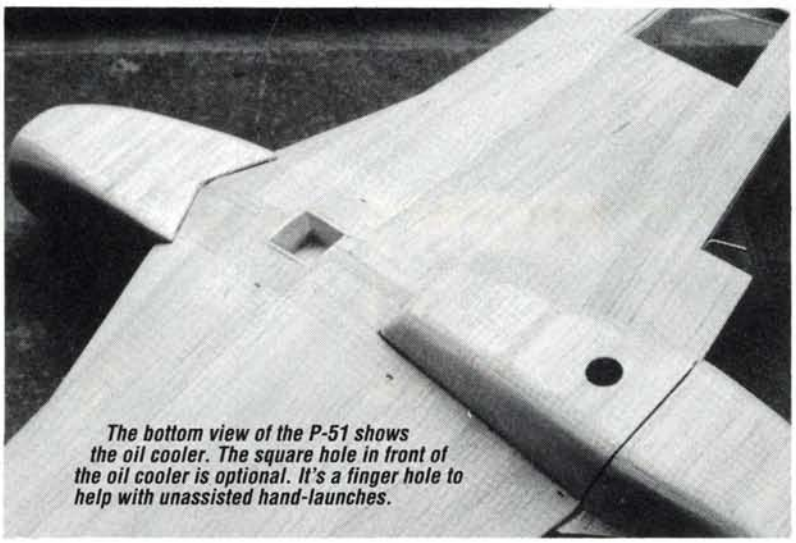


The wing has a minimum number of ribs to minimize weight and building time.

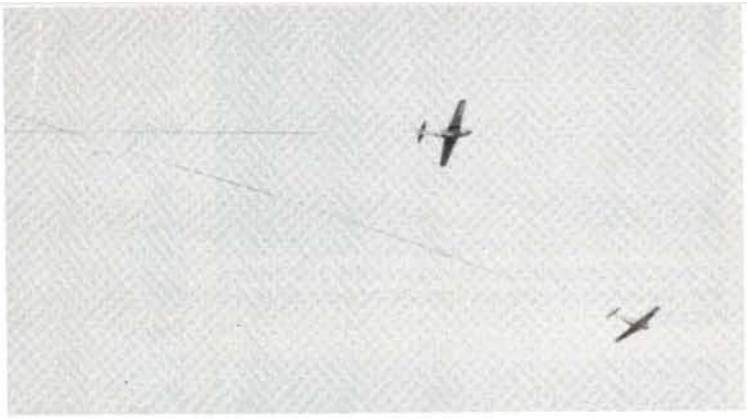


The nearly completed wing, showing the torque rod and center-section detail.

The P-51's 1 1/2-inch pilot is a trimmed down Williams Bros. figure, and the canopy is a 9-inch WW II canopy from Sig Mfg.



The bottom view of the P-51 shows the oil cooler. The square hole in front of the oil cooler is optional. It's a finger hole to help with unassisted hand-launches.



P-51 MUSTANG AND Bf-109

throws (see plans), because too much can make for a real handful! Check and adjust the CG, both fore and aft, and side to side.

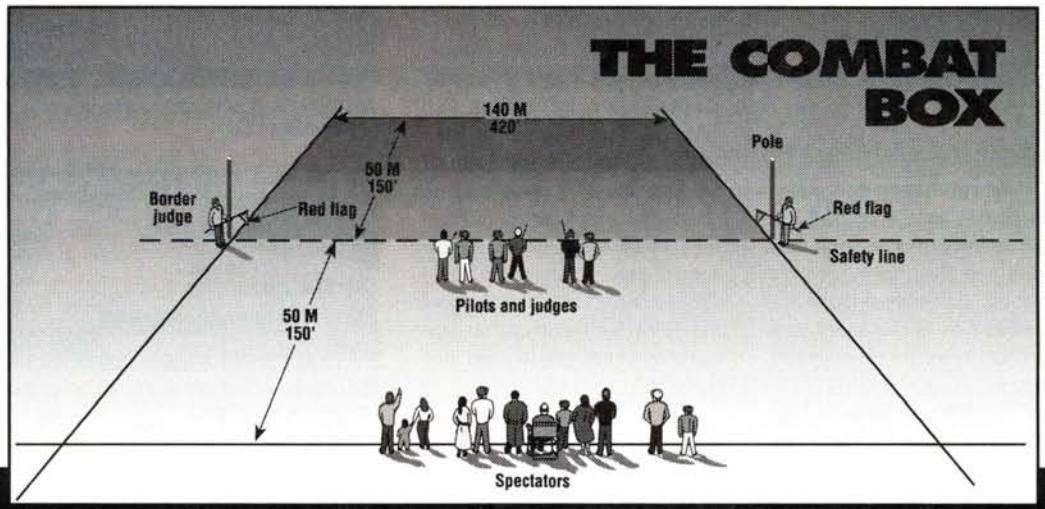
FLYING

A moderate toss into the wind (by someone other than the pilot, if possible) will easily get these fighters airborne. With the recommended control throws, flight is very smooth and stable. If too much throw is used, especially elevator, they'll "snap out" of a hard pull-up. Recovery, though, is immediate when the elevator is released. Flying combat, it's tempting to put lots of control throw in to turn more tightly, but remember that we're trying to emulate WW II fighters and their large, graceful maneuvers.

Landing is easy if the throttle is set up to cut off when the trim is pulled back and the prop is aligned to stop horizontally. The glide is relatively shallow, unless a streamer is still attached (meaning you haven't been shot down!), in which case your plane will descend much quicker. Just remember to aim for grass, *not concrete (ouch!)*.

After a successful combat mission, we'll see you at the officers' club for some "hand-flying" and swapping tales about how many bad guys you flamed! You're buying!

**Here are the addresses of the companies that are mentioned in this article:*
Sig Mfg. Co., *401 S. Front St., Montezuma, IA 50171.*
Progressive Miniature Aviation, *214 N. Goldenrod Rd. A-16 Orlando, FL 32807; (407) 382-8646.*



FIGHT TO THE FINISH

New for '92 is a provisional AMA event called "WW II Combat," the objective of which is to "recreate the excitement of WW II combat in an enjoyable, safe, scale competition."

Basically, this event involves 1/12-scale sport-scale replicas of fighters that operated from 1935 to 1955. The 1/12-scale (1 inch to 1 foot) requirement must be met to within 5 percent for wingspan, length, tail span, rudder height and fuselage cross section. The maximum weight allowed is 2.2 pounds for a single-engine model and 2.5 pounds for a twin.

The engine limitations specify: .15 for a single-engine design in which the full-scale plane was powered by an in-line engine (P-51, Bf-109, P-40, etc.) and .20 for single-engine designs where the full-scale plane was powered by a radial engine (P-47, FW-190, A6M Zero, etc.). Any engine within these limitations is allowed, but tuned pipes are forbidden. In a twin-engine aircraft, the total displacement must not exceed .20 (two .10s).

The aircraft may be launched by hand, dolly, catapult, or wheels (if installed). Each aircraft will pull a streamer that's 30 feet long and approximately 1/2 inch wide; it will be secured to the aircraft with 5 feet of cotton string.

The provisional scoring system is fairly complicated and uses a system that awards points for being the first airborne, flying the longest, surviving a midair and, obviously, cutting an opponent's streamer. Points will be lost for failure to become airborne in time, crossing safety lines, crash-landing after midairs, etc. Consult the 1992/1993 Competition Rules guide for full details of the rules.

To my knowledge, very few kits fit these requirements. Some could be modified to meet the 5-percent rule, but the 2.2-pound rule really encourages scratch-building. As well as the P-51 and Bf-109 presented in this article (they were designed specifically *for* this event), other designs in *Model Airplane News's* vast inventory of plans could be used.

Rich Uravitch's 40-inch-span P-47 Thunderbolt (plan no. FSP06843) is just under 1/12 scale. J.P. Neate's stick-and-tissue F4F-3 Wildcat (plan no. FSP09791) is almost exactly 1/12 scale and would certainly come in well below 2.2 pounds. And if you stretch the term "fighter" a little, Rich Uravitch's AT-6 Texan (plan no. FSP04821) will also qualify.

Greg Rose wrote the rules for the new AMA 704 WW II (combat) event and is forming a national combat organization. For information on dogfighting and additional sources of plans, contact Greg Rose, 3429 Elmy, Orion, MI 48359.

HOW TO

Airfoil Selection, Part 1

by ANDY LENNON

Choose the best for your application

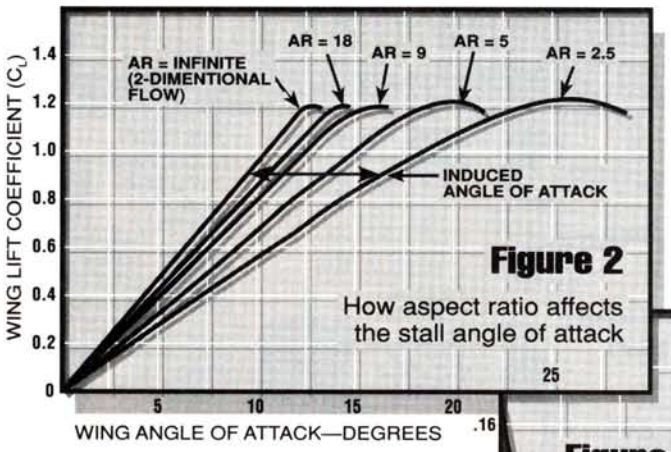


Figure 2
How aspect ratio affects the stall angle of attack

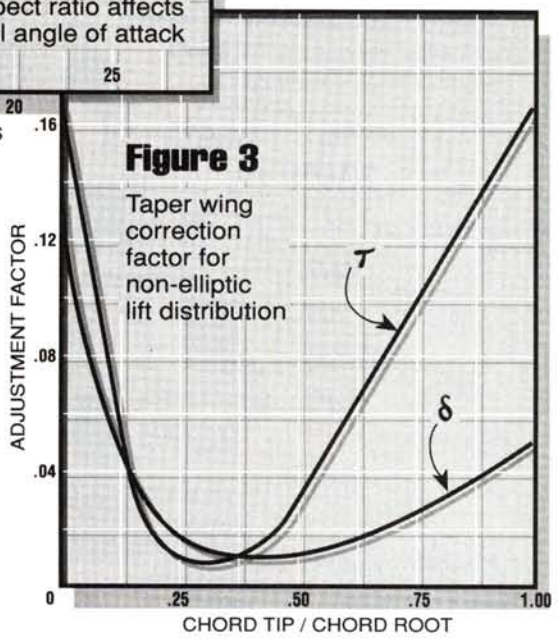


Figure 3
Taper wing correction factor for non-elliptic lift distribution

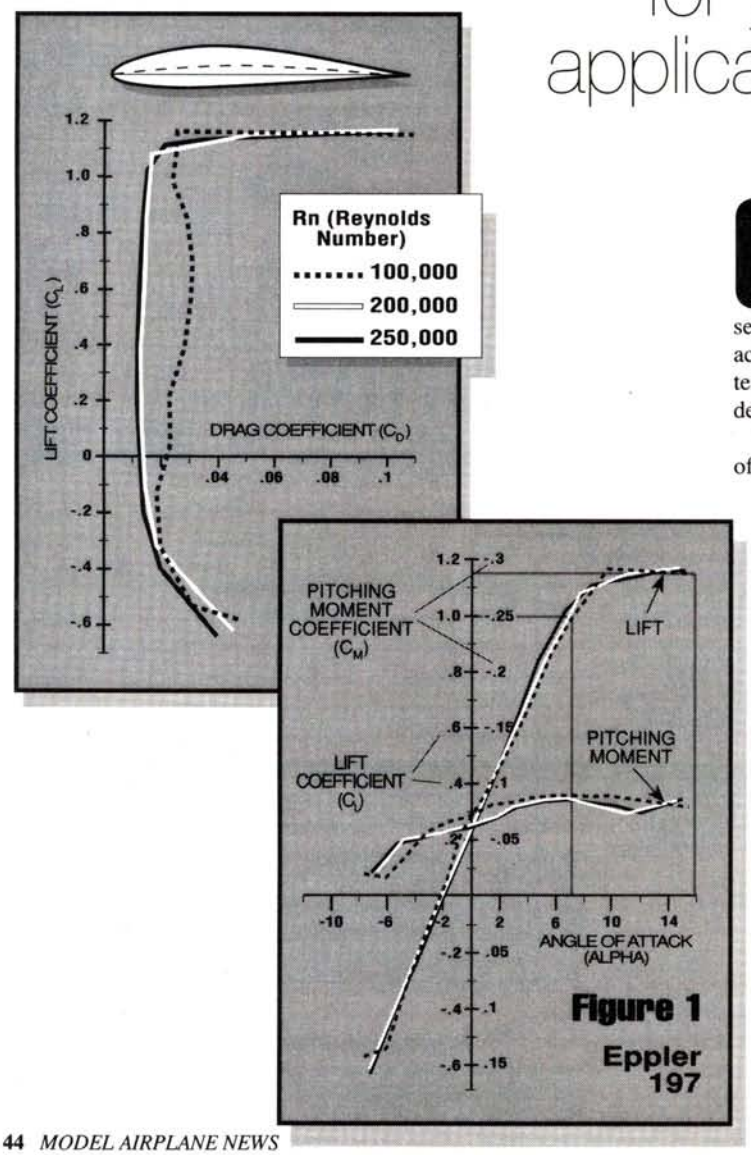


Figure 1
Eppler 197

One of the most important choices in model or full-scale airplane design is the selection of an airfoil. The wing section chosen should have characteristics suited to the flight pattern of the type of model being designed.

There exist literally hundreds of airfoil sections from which to choose. They are described in "Airfoil Plots" similar to the E197 in Figure 1. Selection of an airfoil demands a reasonable understanding of this data so that one can read, understand and use it to advantage.

Providing this understanding is the subject of this two-part article. Referring to Figure 1, note that the data is given in terms of coefficients, except for the angle of attack. These coefficients are CL for lift, CD for profile drag and CM for the pitching moment around the 1/4-chord point.

The actual lift, total drag and pitching moment of a wing depend on seven factors not directly related to its airfoil section. These are:

- Speed. Lift, drag and pitching moment are proportional to the square of the speed.
- Wing area. All three are proportional to wing area.
- Wing chord(s). Pitching moment and Reynolds number are proportional to chord.
- Angle of attack. In the useful range of lift, from zero lift to just before the stall, lift, profile drag and pitching moment increase as the angle of attack increases.
- Aspect ratio. All three are affected by AR.
- Planform, i.e., straight, tapered or elliptical. All impact lift, drag and pitching moment.
- Reynolds number (Rn). This reflects both speed and chord and is a measure of "scale effect."

In developing these airfoil plots like Figure 1, the aerodynamics scientists have screened out six of these factors, leaving only the characteristics of lift, profile drag

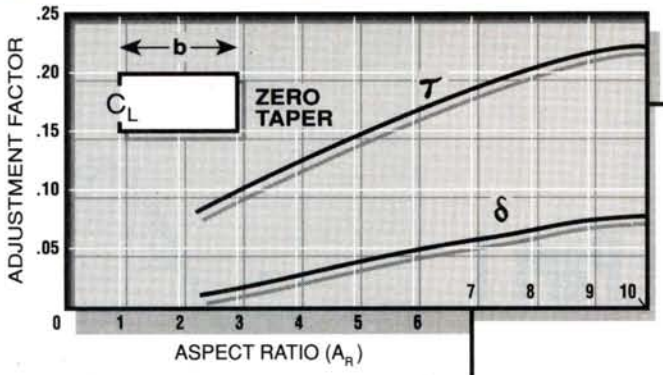


Figure 4

Straight wing correction factor for non-elliptic lift distribution. (Application of Figures 3 and 4 will be clarified further in Part 2.)

and pitching moment unique to each individual airfoil. The seventh, Rn is referenced separately on the airfoil plot.

Formulas (in Part 2) incorporating all six variables and these coefficients permit accurate calculation of the lift, total drag and pitching moments for your wing and choice of airfoils.

However, in the airfoil selection process, it isn't necessary to perform laborious calculations for each potential airfoil. Direct comparison of the curves and coefficients of the candidate airfoils is more easily done, without deterioration of the results. This comparison calls for an understanding of the data. Start by examining Figure 1 in detail.

It covers the Eppler E197 airfoil, which is 13.42 percent of its chord in depth. This plot is the result of wind-tunnel tests performed at the University of Stuttgart in Germany under the direction of Dr. Dieter Althaus.

Let's start with the right-hand illustration in Figure 1. The horizontal line is the angle of attack (ALFA) line in degrees (measured from the airfoil's chord line)—positive to the right and negative to the left.

The vertical line, on its left, provides the lift coefficient CL, positive above and negative below the horizontal line.

On the right of the vertical are the pitching moment coefficients, negative (or nose down) above, and positive (or nose up) below the horizontal line.

In the center are the three Rns covered by this plot, coded to identify their respective curves.

In Figure 1's left-hand illustration, the E197 airfoil is outlined. The chord line is straight and joins leading and trailing edges. The dotted, curved line is the "mean" or "camber" line, equidistant from both upper and lower surfaces.

The vertical line is graduated identically with the lift coefficient line on the right. CL is positive above and negative below the horizontal line, which is itself graduated to provide the profile drag coefficient CD.

Now, back to the curves in the right-hand illustration. The lift lines provide the CL data on the E197 airfoil. Note that this section starts to lift at the negative angle of attack of minus 2 degrees and continues to lift to 16 degrees, for a total lift spectrum of 18 degrees. CL max is 1.17.

These lift curves are section values for "infinite aspect ratios" and two-dimensional airflow. For wings of finite AR and three-dimensional airflow, the slope of the lift curve decreases as shown in Figure 2. At these finite ARs, the angle of attack must be increased to obtain the same lift coefficient. These increases are called induced angles of attack.

For example, Figure 2 shows that if, with a wing of AR 5, you

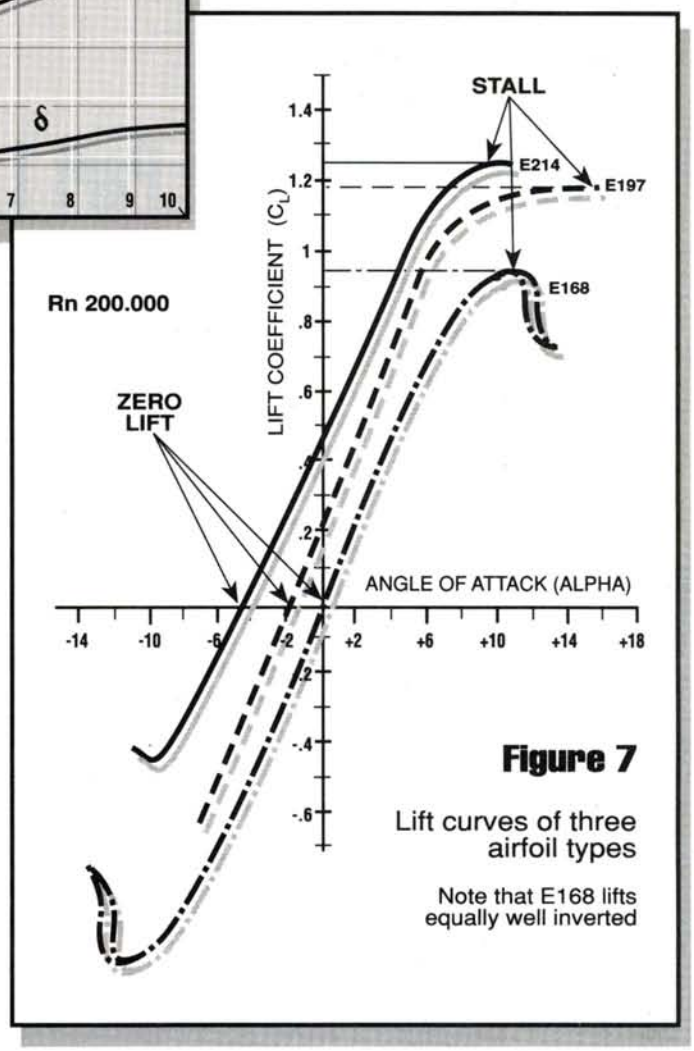


Figure 7

Lift curves of three airfoil types

Note that E168 lifts equally well inverted

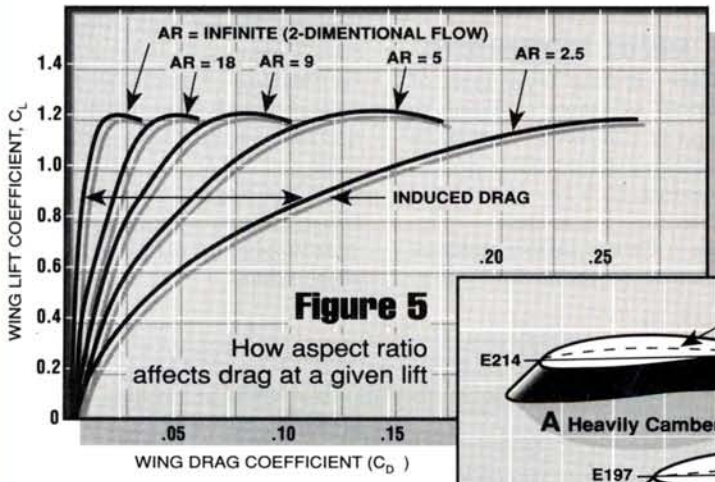


Figure 5

How aspect ratio affects drag at a given lift

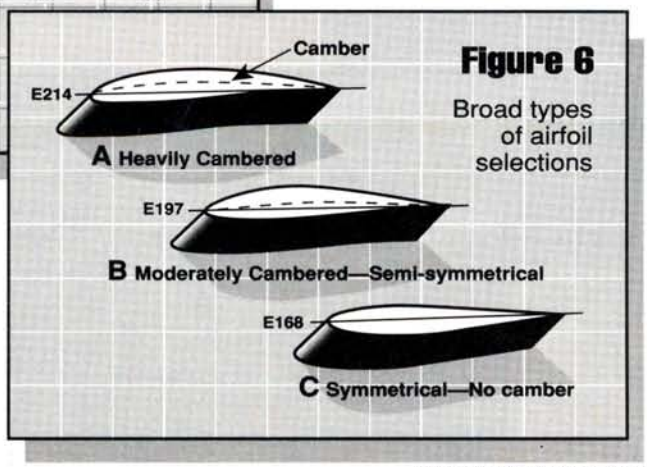
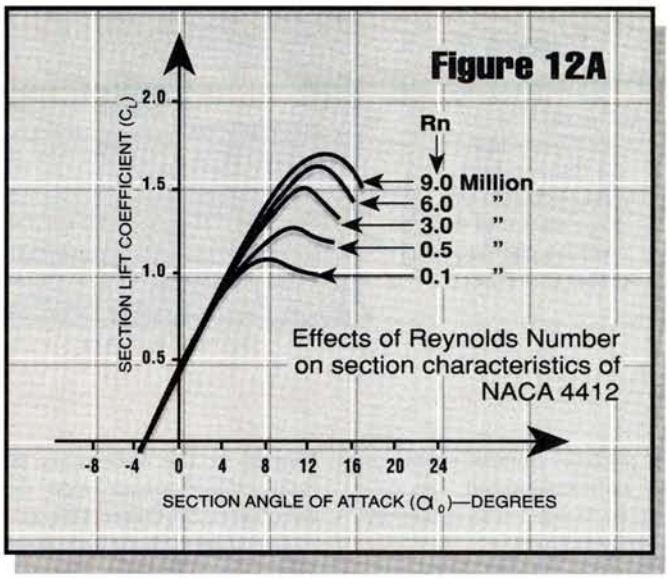


Figure 6

Broad types of airfoil selections

ILLUSTRATIONS BY JONATHAN T. KLEIN

Airfoil Selection, Part 1



can achieve a CL of 1.2 with an angle of attack of 20 degrees, then with an AR of 9 you can achieve the same CL with an angle of attack of 17 degrees. A higher AR wing will stall at a lower angle of attack.

In addition, the angle of attack must be increased to compensate for the fact that straight and tapered wings aren't as efficient as the ideal elliptical wing planform. Figures 3 and 4 provide adjustment factors (τ, or tau).

The pitching moment curves quantify the airfoil's nose-down tendency, increasing with increasing angle of attack, but not linearly like the lift curves.

The curves in the left-hand illustration of Figure 1 are called "polar curves," since they compare lift coefficient CL against profile drag coefficient CD. Note that E197 shows very little increase in profile drag despite increasing lift, except at the lowest Rn.

Again, these are section values. The profile drag values do not include induced drag, defined as "the drag resulting from the production of lift" and which varies with AR as shown in Figure 5.

Wing planform also affects induced drag. As shown in Figures 3 and 4, the curves identified by δ (delta) provide the adjustment factor to adjust induced drag to compensate for the wing's planform. The total wing drag coefficient is the sum of profile and induced drag coefficients.

In clarification, angle of attack is the angle at which the wing strikes the air, in flight, measured from the chord line.

Angle of incidence is a drawing reference and is the angle of the wing's (or horizontal tail's) chord line relative to the aircraft's center or reference line.

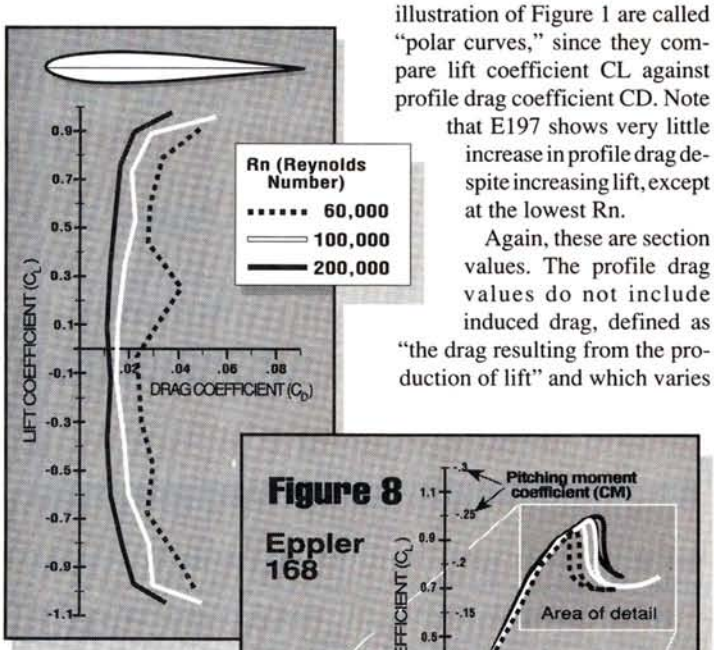
AIRFOIL COMPARISONS

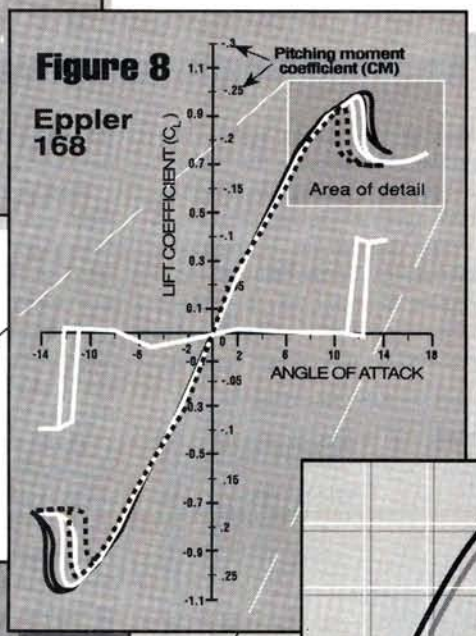
There are three broad types of airfoil, as shown in Figure 6: heavily cambered, moderately cambered and no camber, or symmetrical. Each type has its own characteristics, as shown in Figure 7. Greater camber increases CL max; moves the lift curve to the left so that the angle of zero lift becomes increasingly negative, and the positive angle of attack of the stall is reduced. Note that symmetrical airfoils lift equally well upright or inverted.

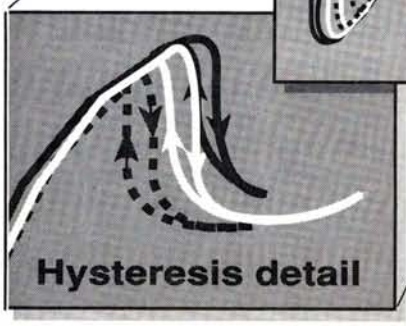
STALL PATTERNS

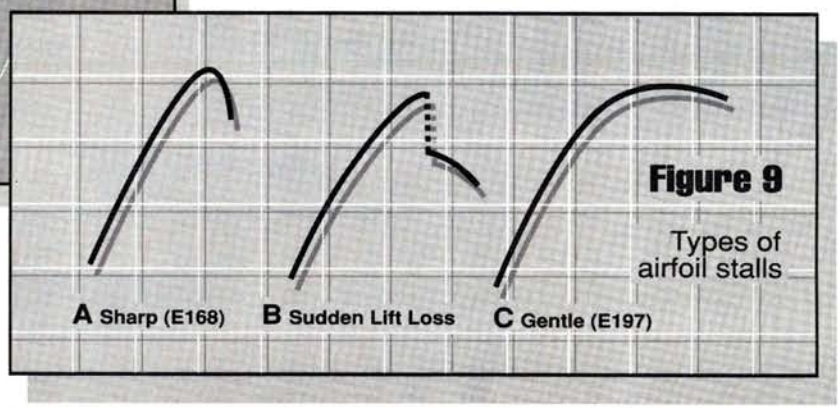
There are three major types of airfoil stall pattern, as in Figure 9: sharp, as for E168 in Figure 8; sudden lift reduction, as in Figure 9B; and the soft, gentle stall of figure 9C and of E197 in Figure 1.

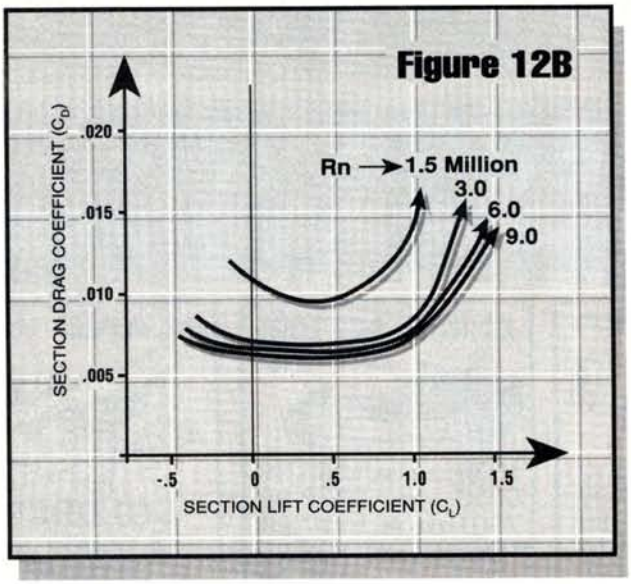
E168 in Figure 8 shows another airfoil quirk. At the stall, lift drops off but doesn't return to full value until the angle of attack is reduced by a few degrees. This phenomenon is more pronounced at low Rn. This is called "hysteresis" and is caused by separation of the airflow on the wing's upper surface at the stall that does not re-attach until the angle of attack is reduced. Some airfoils have a more emphatic version of this phenomenon.

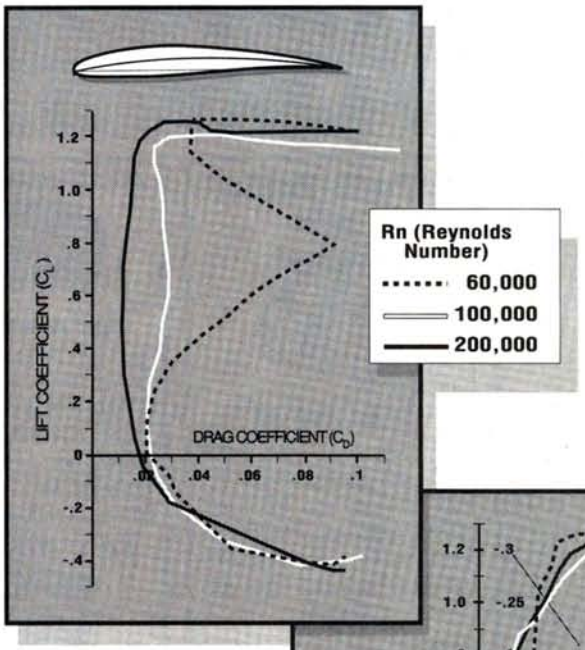








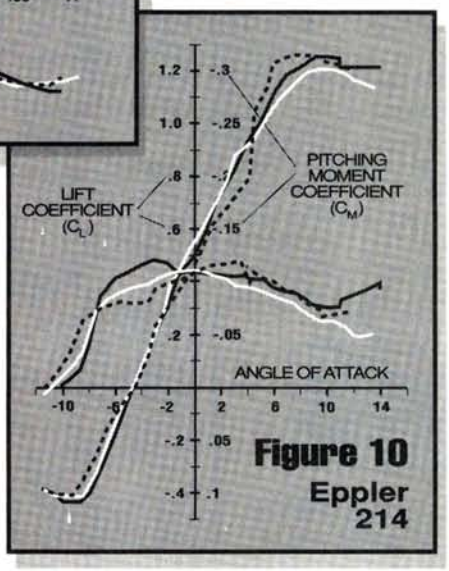


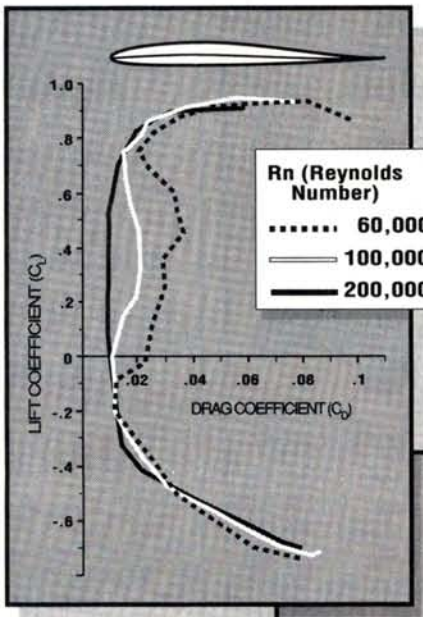


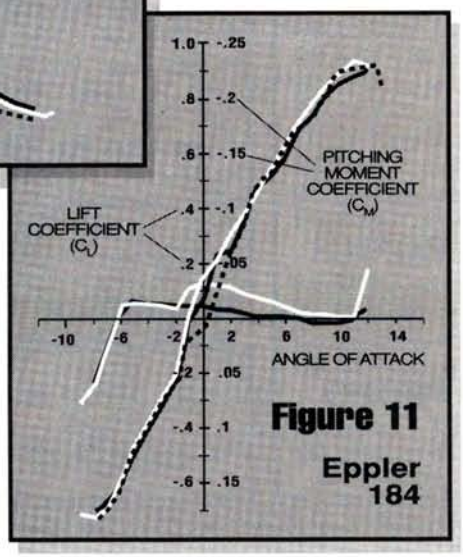
PITCHING MOMENT

Compare pitching moments of airfoils in Figure 1 E197, Figure 8 E168, Figure 10 E214 and Figure 11 E184. The more heavily cambered the section is, the greater the negative pitching moment. Compare Figure 1 E197 and Figure 10 E214.

The symmetrical section in Figure 8 E168 has virtually no pitching moment except at the stall, where it becomes violently negative. This is a stable reaction. The airfoil strives to lower its angle of attack. E168 would be an excellent pattern-ship airfoil selection; CL max is good, and it's thick enough for sturdy wing structures. Airfoil E184 in Figure 11 has a reflexed mean line toward its trailing edge. This acts like "up-elevator," reducing the pitching-moment coefficient, but also reducing CL max. In airfoils, you don't get anything for nothing. E184 is designed for tail-less models—and note the zero lift angle of attack shift to the right at low Rn.







DRAG AND Rn

The left-hand curves in Figures 1, 8, 10 and 11 show the adverse reaction, in both CL and CD, to lower Rn and to increasing angle of attack. Each airfoil has a different reaction—and this should be a serious consideration for narrow wing tips and small tail-surface chords, particularly where, at low Rns, there's a reduction in the stall angle of attack and higher profile drag.

The highest Rn in these plots is Rn 250,000. For a wing chord of 10 inches flying at sea level, this is equivalent to a speed of 32mph—ideal for sailplanes, but low for powered models, except at landing speeds. A 10-inch chord flying 90mph is at Rn 700,000 at sea level.

As Figures 12A and B indicate, both lift and drag improve at higher Rn, improving the E197's good performance.

Part 2 of "Airfoil Selection" will provide formulas for the simple, but necessary, calculations involved in wing design and sources for airfoil data. ■

HOP-UP THE ZENOAH G-23

EASY BOLT-ON POWER

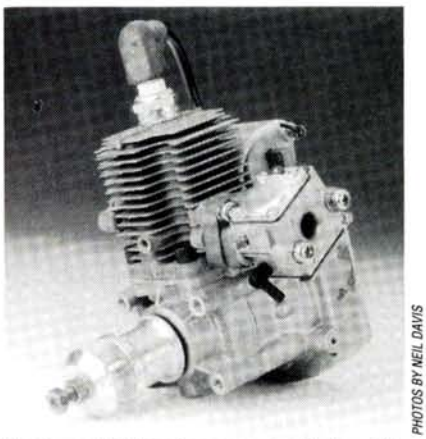
by NEIL DAVIS

I RECENTLY read an announcement in my Peninsula Channel Commanders Club newsletter about a local R/C zealot who's producing high-power after-market components (hop-up parts!) for the Zenoah G-23 engine. This is the engine I use and love in my 1/4-scale model of the J-3 Piper Cub, built from a Sig kit. For those of you who aren't familiar with this kit, this is a 105-inch wingspan, 14 pound airplane—a big, easy-to-fly and "fun" model. The newsletter article claimed an increase to as much as *double* the stock horsepower. The newsletter also said, however, that this hopped-up G-23 is used for high-speed R/C boats. OK; no problem. If the engine can produce big power in a boat, why not the same in an aircraft?

Fifteen minutes after a friendly phone call, I had the privilege of meeting Bruce Hanson, owner of B.H. Hanson Co.—Model Marine Products*. Bruce is an engineer and former Air Force jet pilot. This guy is no stranger to R/C aircraft. Bruce currently owns and often flies model airplanes, and in 1975, he competed in the Tournament of Champions. His principal interest is in producing and selling variations of the 22.5cc Zenoah G-23 engine as well as high-performance, bolt-on components for it.

The good news out of all of this was, yes, I could purchase an air-cooled version of the higher-performance cylinder along with the larger carb and a solid-state ignition system.

After that, I could hardly wait to bolt on the goodies and fly.



PHOTOS BY NEIL DAVIS

The Zenoah G-23 as it comes out of the box. The hop-up parts can be easily bolted on.

AVAILABLE HOP-UP PARTS

New cylinder with necessary gaskets—$62.50. This cylinder isn't a re-work of the stock item. To achieve the sufficiently large fuel-transfer ports and the larger intake and exhaust ports, the cylinder must be manufactured specifically as a high-performance replacement. The new cylinder also includes a redesigned squish band that results in a slightly higher compression ratio. This could be a favorable replacement alternative if you damage your cylinder in a re-kitting maneuver. Laugh not; one of my flying buddies did just that.

Part of your hop-up will include turning the piston 180 degrees. This will ensure that the rings don't catch on the edge of the transfer ports. If your engine is getting tired, this would be a good time to also replace the piston and rings (available from Hanson at $35). You now have a "top overhaul" and should be able to look forward to many more operating hours. This engine is rated as a 1,000-hour engine, and Bruce tells me that the original lower end is so strong and the new parts of such high quality that the hop-up won't shorten engine life.

The high-performance carburetor kit, including a new manifold and gaskets—$62.50. This is basically a larger carb that allows you to take maximum advantage of the enlarged cylinder intake port and will supply a sufficient amount of mixture for the new, internal-cylinder, fuel-transfer ports. Bruce explained that you don't get more power just by installing a

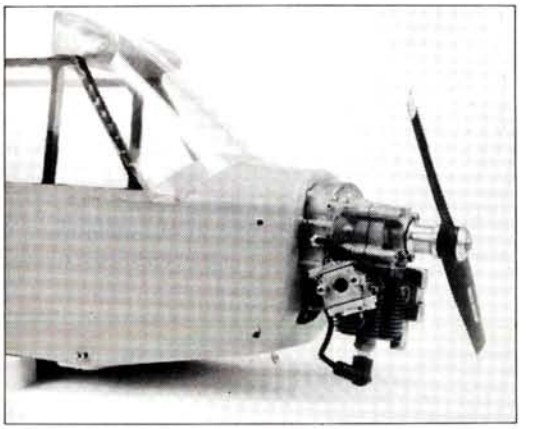
SPECIFICATIONS

Displacement	22.5cc
Fuel	Super unleaded 40:1 oil mix (Echo Premium chain-saw oil)
Prop	Dynathrust 16x8
rpm before mod.	7,400 with Tatone Pitts-style manifold
rpm after mod.	9,000 with Tatone Pitts-style manifold
hp before mod.	1.8
hp after mod.	2.8
dB level	104 on hard clay with floats attached; 98 on level grass with wheel landing gear

Note: use of the Hanson muffler produced 8,300rpm and 94dB.

COURTESY OF SIG MFG.

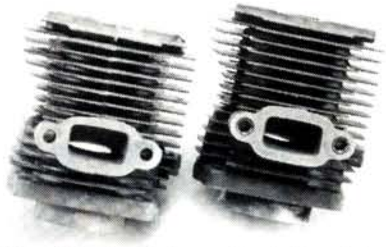
The Sig 1/4-scale J-3 Cub and the Zenoah G-23 are an excellent combination. With the extra hop-up power, the model climbs and flies with authority.



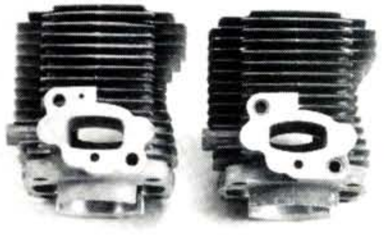
The newly modified engine installed on author's 1/4-scale Cub.

HOP-UP THE ZENOAH G-23

A combination hop-up kit for fliers. This includes the cylinder kit, new piston rings, the carb kit and the ignition module.



The original cylinder on the right and the high-performance cylinder on the left. Notice the larger exhaust port and the heavier casting in the cooling-fin area.



The high-performance cylinder on the left shows the larger intake area, and the mounting base is compatible with the larger carb.

larger carb on a standard cylinder. For a larger carb to give you any appreciable increase in power, the engine cylinder must be modified so that it will pull a greater volume of mixture "through the hole"! This is the reason for modifying the cylinder. The larger fuel-transfer ports and the larger intake and exhaust ports allow more of the fuel mixture to pass through the carb, into the combustion chamber and out through the exhaust. More fuel burned equals more power. Now that's kind of a simplistic explanation that could annoy some of the more scientific types. But let's face it folks: I'm a simple kind of a guy—one who likes to see his Piper Cub go way up and keep going up until it's just a little dot way up in the sky, then put it into a spin and see how many times it spins before I chicken out!

The solid-state ignition module—$17.50. This eliminates the magneto points (located in front of the flywheel) and provides 5 degrees of ignition advance as rpm increase; easier starting; smoother idling; better transition from idle to mid range; and an additional top-end power output.

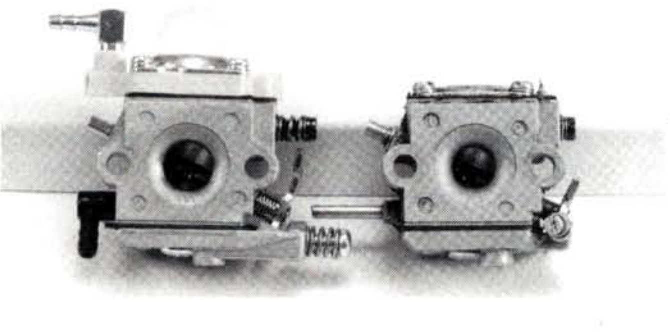
Bruce tells me he'll also offer a combination hop-up kit for fliers. This will include the cylinder kit, new piston rings, the carb kit and the ignition module, all for $129.50.

Let's not forget the dreaded noise problem! Bruce offers a direct, bolt-on muffler that will provide a maximum noise level of 94dB. Complete with bolts and gasket, this little jewel sells for only $19. The Pitts-style manifold that I've been using on my engine was measured at 104dB. I tried the new muffler, and it's considerably quieter (see specification box). I wasn't able to use it on my engine as it didn't fit under the cowl of the Cub. The rpm readings in this article were taken using my Pitts-style manifold.

IN THE AIR

How the Cub flew before and after the engine modifications: this airplane has always been a great flier! The original engine was a Super Tiger .90 that provided more than enough power for realistic scale performance. This was the lightest engine installed so the plane could fly *veeerrry*

(Continued on page 74)



The larger carb on the left includes a pump (clear flexible bowl on the top) that's used to draw fuel manually from the tank to the carb.

THE NORTH AMERICANS BREAK NEW GROUND DOWN UNDER

by GUY REVEL

ACCLAIMED BY most competitors as the best World Championships so far, the tense and exciting events that took place in Wangaratta, Australia, certainly deserve a very special place in FAI competition, for they underlined a fast evolution with clearly visible trends. A shift of supremacy was seen in aerobatics and helicopters as a result of an underground movement only now coming into full effect. Although competition included aerobatic power (F3A), pylon racing (F3D) and helicopters (F3C), I'll report here on the fixed-wing events.

For most modelers who follow pattern, the 1991 World Championships will be remembered as the event in which Hanno Prettner lost his title. To me, however, this is a mere incident compared with the upsurge of flying excellence from America. Americans haven't dominated the F3A scene since their last individual

During the awards ceremony: Chip Hyde, winner of the F3A division at the 1991 World Championships.

FEDERATION AERONAUTIQUE INTERNATIONALE

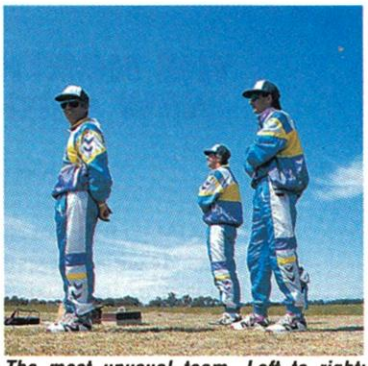
FAI AEROLYMPICS

Above: the Chinese F3A team.

Peter and Caroline Godsmith with the "Slingshot." They finished 14th.

PHOTOS BY GUY REVEL

The top JR pilots, left to right: Bertram Lossen, Chip Hyde and Hajime Haita.



The most unusual team. Left to right: Wolfgang, Norbert and Roland Matt (Liechtenstein).

victory (Phil Kraft) in 1967. Their fortunes then slowly declined in favor of European (and mostly German) pilots. Then the wave rose again, climaxing in Wangaratta with a U.S. individual title in F3A, a team title in F3C, and two U.S. pilots in the top three, both in F3A and F3C. Don't forget the impressive Canadian team victory in F3A.

Hans and Hanno Prettner. The heavy model was designed to fly best in the wind, but the judges liked larger maneuvers.

I'm reminded of the similar strength of U.S. pilots at the last F3B World Championships in the Netherlands, as well as their unexpected and significant showing at the last F3E World Championships in Austria. This shows even more clearly how the wave is shifting from Europe to America.

WELL DONE, AUSSIES!

As a result of a late decision to change the location of the 1991 World Championships from Italy to Australia, the Australians were left with little more than six months to set up a huge organization for three simultaneous championships (F3A, F3C and F3D) similar to the last "Aerolympics" in 1989. They succeeded with a superb and very efficient organization.

Wangaratta, in the southeast corner of Australia, about 120 miles north of Melbourne, is a small, quiet city established about 150 years ago as a result of a gold rush.

GOOD SITE

Before the beginning of the championships, competitors were provided with a

The new O.S. .40 is a real powerhouse. Very sound design with an elaborate induction system.

Above: winning F3A Canadian team is greeted with champagne by Bill Cunningham.

Right: some of the action in the pylon racing com-petition. Close race.

FAI AEROLYMPICS

Above: David von Linsowe and Bill Cunningham. The USA Star was the largest model on the field. It flew slow, impressive maneuvers. Right: Dave Shadel flew this Stiletto to a 3rd-place win.

variety of club flying fields where they could practice. It was astonishing how many club fields (most of them on sheep grazing farmland) there are within a 30-mile radius of Wangaratta in a region that, although densely populated by Aussie standards, has a total population of about 50,000.

The Drage Airfield, site of the World Championships, has one long asphalt runway along which were two F3A flight sites. F3D was run earlier in the morning farther upwind on the same runway. The spring weather was unusually cold but convenient for most competitors, with very cool mornings and warm, sunny afternoons. The competition began with a no-wind condition akin to the previous World Championships, but a gusty and rather strong wind came later, just to make things more interesting and help separate the best pilots.

F3D: AN AMERICAN SOLO

The pylon racing class has long been an American, Australian and Czechoslovakian speciality but, since the first World Championship where the Malina brothers won the individual title and the Australian the team award, the American domination became almost absolute.

The event was, as expected, a race between Americans with times usually under the 75-second mark for the 10, 400-meter laps. Just as a reminder, F3D races are flown against the clock. The Australians, who were usually the only serious competition to the U.S. pilots, couldn't follow the pace, and Ranjit Phelan, their most experienced specialist, even suffered so many troubles that he could finish only five races out of 14 (of which the best 12 were taken for the final results).

The usual battle between world champion Dave Shadel and his "traditional" opponent Dubb Jett finished this time in favor of the latter, who showed remarkable consistency. All of his four last rounds' times improved on the previous world record! Remarkable flying indeed with a trend-setting model, inverted engine and high-aspect-ratio wing.

Behind the four American pilots, Japan's Nobuyuki Chujo displayed remarkable flying style and performance, his best time of 72.1 being near last time's winning times. I was impressed by his prototype O.S. 40 racing engines, which could well become the only serious opposition to the ubiquitous Nelson.

Technically, the Nelson engine, which was still a prototype two years ago, is now the accepted standard. The once-supreme Super Tigre X-40 was used only by Jett and a New Zealander. OPS engines seemed to be very critical and short-lasting, and Rossis were favored by only the German team and one Australian. The new O.S., which seems very promising, has already been presented in Japan and may be considerably less expensive than the Nelson.

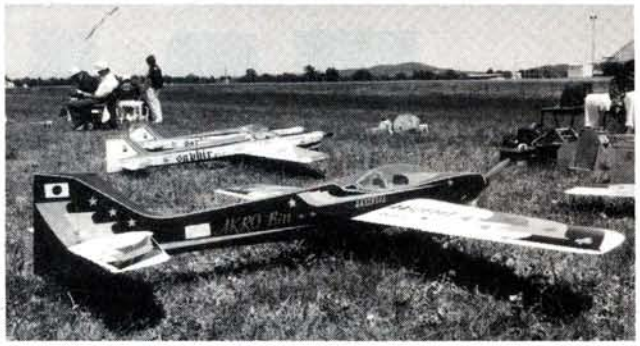
F3A: TIME FOR A NEW FLIGHT STYLE

It was quite a revolution that the German team wasn't in the top three and was even challenged for 4th place by Liechtenstein and Australia. For many, the big news is that Prettner was stripped of his traditional title. This was the feat of Chip Hyde, but I consider this of secondary importance in the big fight between the world's top pilots.

As usual, the Championships began with four rounds of what are really qualifications—two rounds in front of each of the two judges panels. The three best flights are taken into account for the preliminary classification. Then the top 20 percent—in this case, 13 pilots—go on with three more rounds in front of all 10 judges.

It was soon evident that the points were going very high, with 500 points more and more common with the passing days. Hyde (USA) and Somenzini (Argentina) received much higher points than ever before; Akiba (Japan) and Kristensen (Canada) seemed to be better than they ever were. Wolfgang

Only during the finals was it possible to see models together. Here are the Japanese and Liehtenstein models.



Yoichiro Akiba's Acro Bit (front) and Wolfgang Matt's Saphir.

THE JUDGES FAVORED THE LARGE, EVEN *VERY LARGE* MANEUVERS, ALTHOUGH THE AVERAGE SPEED SEEMED TO BE THE SAME, OR EVEN LOWER THAN, AT THE PREVIOUS WORLD CHAMPIONSHIPS.

Matt had very clean flights, but it seemed that Hyde had more points every time, and with a very different flight style.

Prettner displayed his usual clean, smooth flights, just with somewhat smaller maneuvers than the opposition. Prettner had a new model, the Mystic 120, with an O.S. 120 4-stroke engine. He just received less points than could be expected, just like Matt and Bertram Lossen. In Wangaratta, the European style was clearly *not* favored by the judges.

This just shows the difference between national and international competitions. In the first case, competitors and judges have a common standard established through continuous exchanges from contest to contest. When you go to another country, the standard is different because the rules, as precise as they are, can't define everything. A world champion is judged to be best under different interpretations of the rules without arguing which is the valid one. Even if, however, the provisional classification wasn't really as expected, none of the favorites was left behind the final rounds.

ANTICLIMACTIC FINALS

For the first time ever, the finals included three Canadian pilots, but only one German competitor. Newcomers were Americans Bill Cunningham and David von Linsowe, the latter flying for the first time at an FAI World Championships, and Canadian Greg Marsden, who had been on the team previously, but who had never made the finals. Leading at the end of the qualifying rounds were Hyde (2,991 points), Somenzini (2,966), Prettner (2,919), Akiba (2,919) and Ivan Kristensen (2,919). The three final flights could still change everything; and they were flown with a strong crosswind, making really perfect flights that much more difficult.

In fact, there was no surprise as far as points are concerned. Hyde, who was already leading, easily got the best points for each of his three flights to record a clean win with the maximum possible. His scores of more than 530 points for five out of his seven flights say clearly how his flights were to the agreement of the judges. He was, however, tightly challenged by Somenzini, flying in a very different style, but extremely convincingly.

Kristensen never flew better. Using the very same model he had two years ago, his flights were precise, smooth, geometrically perfect, with large maneuvers and short curved changes of heading between straight legs. Obviously, the judges favored the large, even *very large* maneuvers, although the average speed seemed to be the same, or even lower than, at the previous World Championships.

Yoichiro Akiba (Japan) and his Acro Bit.

WHERE'S THE TRUTH?

Was Hyde really better? As always this is open to question, as one has to take into account the human factor; judges aren't machines. In past years, the gap between Prettner and his followers was narrow; this time, it was even more so, and personal preferences could easily account for the finishing order of the top five pilots—particularly so with the differing flying styles. Hyde has a rather nervous style, with low base altitude and sharp changes of heading. He often avoids making path corrections when they'd be too obvious. This way, the overall impression is one of self-confidence.

Top-Ranking Pylon Teams

1.—USA
Dubb Jett
Henry Bartle
Lyle Larson

2.—Japan
Nobuyuki Chujo
Kiyoshi Soeda
Yoshinori Sato

3.—South Africa
Peter Sherliker
Dean Mitchell
Graeme Cox

4.—New Zealand
Tony Thompson
John Danks
Rob Whalley

5.—U.K.
Keith Reid
Paul Board
Alan Laurie

Top-Ranking Aerobatics Teams

1.—Canada
Ivan Kristensen
Dave Patrick
Greg Marsden

2.—USA
Chip Hyde
David von Linsowe
Bill Cunningham

3.—Japan
Yoichiro Akiba
Giichi Naruke
Hajime Hatta

4.—Germany
Bertram Lossen
Peter Erang
Peter Wessels

5.—Liechtenstein
Wolfgang, Roland and Norbert Matt

FAI PYLON INDIVIDUALS

Place	Name	Nation
1	Dubb Jett	USA
2	Henry Bartle	USA
3	Dave Shadel	USA
4	Lyle Larson	USA
5	Nobuyuki Chujo	Japan

FAI AEROBATICS INDIVIDUAL

Place	Name	Nation
1	Chip Hyde	USA
2	Quique Somenzini	Argentir
3	David von Linsowe	USA
4	Ivan Kristensen	Canada
5	Hanno Prettner	Austria

FAI AEROLYMPICS

Japanese Stiletto with O.S. 40.

On the other hand, Prettner, flying in his usual very smooth style, did geometrically near-perfect maneuvers with many, almost imperceptible, constant corrections. It was the first time Prettner flew with a 4-stroke engine, and this aboard a new model. I suspect that he didn't have much time to work on the structure, for the Mystic 120 was quite heavy; in fact, heavier than all but four models. This was surprising, as Prettner has noted that a light model and a lot of power are keys to success.

He said that he decided on a heavy model owing to the expected wind conditions in Wangaratta. This certainly accounts for the lesser vertical performance of his plane. Compared with the vertical performance of the surprising von Linsowe with an airplane almost as heavy (he used the new YS 120 AC 4-stroke engine), however, one also wonders whether Prettner's O.S. 120 4-stroke had too much weight and too little power.

GLANCE INTO THE FUTURE

Somenzini had already flown at a number of World Championships, but he really made himself known in 1987. Since then, he has challenged all the top pilots. He has now reached his maturity. His flying is not only precise and smooth, but it's also inventive. I can only relate his present F3A style to the way he won so convincingly the Free Style event at the last TOC. Although the rules spell very precisely how the maneuvers should be performed, Somenzini still succeeds in adding to them a further element—rhythm. It's a kind of dancing grace by which the flight is not only accurate and interesting for the specialists, but also enjoyable for the ordinary spectators.

The Swiss had a solar panel on their transmitter box to keep it fully charged at all times.

Prettner had a big impact on F3A competition with his now widely recognized constant-speed

(Continued on page 74)

MY PERSONAL SCALE

*

UP

Chip Hyde
Quique Somenzini
Ivan Kristensen
Yoichiro Akiva
The Canadian team
The Liechtenstein team
YS engines
APC props

*

LEVEL

Hanno Prettner
Wolfgang Matt
Giichi Naruke

*

DOWN

Bertram Lossen
The German team
Hajime Hatta
Heinz Kronlachner
Asano and MK props

*

TO BE CLOSELY FOLLOWED

Dave von Linsowe
Peter Erang
Christopher Paysant-Leroux
The next Chinese team
Australian Bolly props and pipes
New Webra Competition Red Head .61

Model	Wingspan (in.)	Length (in.)	Wing Area (sq. in.)	Weight (oz.)	Engine	Prop	Radio
Bummers Bullet	58	39	450	77.6	STX-40	Jett 7.75x7	Airtronics
Stilletto	56	42	465	77.5	Nelson	Carbon 7.5x6.5	Futaba
Stilletto	57	39	450	80.0	Nelson	Own 8x7	Futaba
Stilletto	56	42	465	77.5	Nelson	Carbon 7.5x6.5	Futaba
Stilletto	51.5	41	533	77.0	O.S. 40 Prototype	Own	JR PCM-10

Model	Wingspan (in.)	O/A Length (in.)	Wing Area (sq. in.)	Weight (oz.)	Engine	Propeller	Fuel (oil/nitro)	Radio
Jekyll	66.0	72.0	770	132	Webra LS Comp.	APC 12x13 N	Power Master 15/25	JR PCM-10
Desafio 2	68.5	68.1	841	138	YS 120 AC	Bolly 14.2x15	Power Master 20/20	Futaba 1024
USA Star	77.0	76.0	1155	160	YS 120 AC	APC 15x12	Pro Power ?/15	Futaba 1024
Summit III	64.0	62.5	800	119	YS 61 LS	APC 12x11	Cool Power ?/15	Futaba 1024
Mystic 120	72.8	63.8	899	162	O.S. 120 SP	APC 13.5 x 13.5	Castrol MSSR 15/15	Graupner MC-20

SPORTY SCALE TECHNIQUES

FRANK TIANO

FRIENDLY FLYING

PHOTOS BY FRANK TIANO

Mel Whitley's new T-6 is simply outstanding. Modeled after a Korean War T-6, it uses an O.S. twin for power. Mel really likes the Texan, but he says that it just doesn't have that "heavy metal" appeal that his Sea Fury does, and he's looking for a buyer!

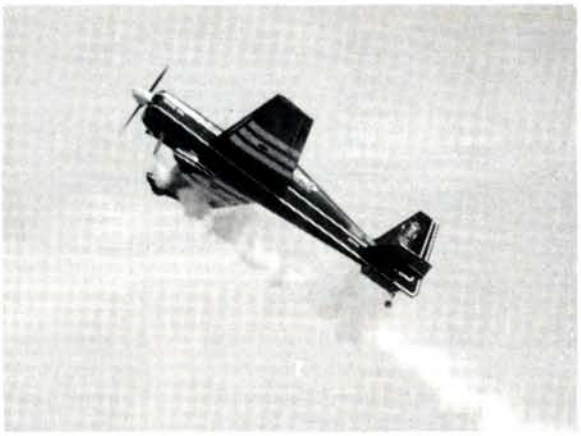
AS PROMISED, this month I'll give you a look at one of the best-attended, most fun-filled scale events in the eastern USA. I'm talking about the "Gathering of Eagles," a fairly new scale fly-in held at the end of the contest season that promotes camaraderie and scale modeling at the same time. The Gathering is promoted by a group of modelers in Mariana, FL, headed by Mel Whitley, last year's Top Gun winner. Mariana is way up there in northwest Florida, very close to Alabama and Georgia. For me, it was a 3½-hour trip from West Palm to Orlando to hook up with Bob Violett, and then another seven hours to Mariana. A long ride, yes, but an enjoyable one when almost the entire trip is spent talking about scale modeling; and that phone isn't ringing every 15 minutes.

The field at Mariana is an abandoned runway in the middle of almost nowhere. Mel's buddies thoughtfully trimmed the wild grass and weeds that seemed to sprout from every expansion joint of the 25-year-old concrete surface. The fly-in was scheduled for late Friday afternoon through Sunday midday. The weather certainly cooperated on both Friday and Saturday, but Sunday was a complete bust; an unexpected front came through 40 days early with near-freezing temperatures and strong winds. As for B.V. and me, we had our share of flying on Saturday. I put the Tony up at least six times, four of them in mass dogfights where we had something like eight WW II fighters in the air at the same time! I even took along my new Byron Mustang for some hot-dog demonstration flying. Unfortunately, I lost the big P-51 when the engine lost power owing to a clogged fuel-filter screen. I still had a grand time! B.V. wowed everybody with that streak of lightning he calls an F-16, and his new T-33 was one of the main attractions of the entire meet. Finally, a jet that we can see; a jet that's truly scale and doesn't require a note signed by Mr. Spock in order to fly it. The T-33 was one of the most stable birds there, regardless of what they were powered by! There were many, many beautiful scale models at the Gathering, and I couldn't help asking Mel how he got so lucky to have such great models in attendance. "Simple," he said. "We simply told everybody that there were no dogs allowed!" We had Bill "Top Buns" McCallie come in from Tampa, Frank Thomas from Niceville, our old friend Jack Dorman from Ft. Walton Beach, Roger Young, all the way from South Carolina, and about 25 other guys from all around the southeastern U.S. Four flight lines provided enough room, enough time and enough security, so there wasn't one conflict all weekend.

Jim Wilkinson's big Stuka has graced our pages before as a mystery guest, on display at last year's Top Gun. It features extraordinary detail and yes, it will compete at this year's T.G. in West Palm Beach.

One of the nicest things about the Gathering of Eagles is that it's held in November when all contest activity is over. Nobody has to worry about damaging his contest ship without having enough time to repair it for the next contest. And it feels pretty good to just wander around the pit area and casually talk with the rest of the guys. It's amazing how much more you notice about an airplane when you're not under the stress of competition. And, like I said, there were lots of really neat airplanes at Mariana that weekend. A new friend, Jim Wilkenson, took some pics for me but, unfortunately, many didn't come

out, so I can't give you a look at the entire field. What we got should give you an idea of what kind of event the Gathering is. Why not try the concept in your area? It has to be a winner.



Dr. Jim Corry showed everybody how an Extra 230 is supposed to perform. The big Zenoah G-62 put out some of the prettiest smoke we've seen in a long time.

TIPS ON CHIPS

Last year, I gave you the address and price structure of a fabulous book you could purchase that contained all the cross-reference information you could ever want concerning color chips and their uses. Well, the book has expanded, the author has moved and the price has gone up. The new IPMS Color Cross-Reference Guide* sells for $31.95, but it includes the entire U.S. Government-issue book of color chips, including those new colors mixed for Operation Desert Storm. How does the book help you? Simple. Let's say you've got a British Spitfire you need color information on. Just look under Great Britain's heading, look down the columns of greens, grays, blues and whatever until you see the word Spitfire. Look across the page, and it gives the color-chip number in the U.S. book of color chips that matches the color used in England in 1942. So, for all who missed the book the last time I mentioned it, don't blow it again. And please, don't write to the author and ask for more information; there isn't any! It's simply a cross-reference book for $21.95 (without color chips) or $31.95 (with color chips). As usual, the address may be found at the end of the column.

My Tony on a fly-by. The 1/5.5-scale bird weighs just over 16 pounds and was the fastest WW II warbird at the Gathering. Power comes from an O.S. 108 turning a Zinger 14x8 prop. Japanese airplanes had some very colorful schemes!

DON'T BITE THE HAND!

Something very, very disturbing has come to my attention over the past several months. When talking with far too many friends who make their living from the hobby industry, I'm hearing the same statements over and over. It's no secret that any time a club hosts an event, whether it's a fun-fly, a pattern or scale

Jack Dorman's new 88-inch Hellcat flew very well, especially since he rebalanced it! The big Grumman weighs 27 pounds and was scaled up from Arthur Bentley's drawings. An O.S. 240 swinging a 20x6-10 prop gives all the performance it needs.

SPORTY SCALE

Another new contestant for Top Gun will be Roger Young and his handsome Douglas C-47 built from Ziroli plans. This bird uses two Enya V-240s for power, and you just have to hear and see this thing fly.

contest, a mall show, a jet-fly, or a local contest, one of the first things they do is appoint a prize-committee chairperson to get whatever donations they can from various manufacturers. You can well imagine that some hobby manufacturers get as many as 50 solicitations for free products a week! And it probably wouldn't take a rocket scientist to realize that no company could honor each and every request for product. So, some just award merchandise on a rotating basis, others tend to support their local events or something on a national level. What does this have to do with my opening statements? It seems that, in far too many cases, those manufacturers who reside in your area are the first people to be looked down upon, talked unfavorably about and, in general, considered highly unwelcome at your local flying fields and club events. Oh yes, it's OK for them to donate merchandise to your club's event, but let's not let them get any friendlier than that! I've had several chances to see (and feel) this in person and as an onlooker; it's borderline criminal, as well as highly uncalled for. I know that it's hard for many modelers to swallow the fact that some people actually make a living from this hobby that we love so much. I understand that there just might be a twinge of jealousy there. But in most cases, those people have worked long and hard to get where they are today, and most are quite receptive to passing some of their good fortune on to local club members in the form of donations or advice. Why not take these people for what they are? —business people who just happen to share the same hobby as the rest of you. In the long run, you and your club will be much better off, you'll have a lot less nonsense to jabber about,s and you may find that manufacturers are just regular guys who want to have fun, too. You really can't hold it against them if they're better builders or fliers than you are; I'm sure they don't resent it if they know you're better cooks or more successful businessmen than they are! Welcome them into your club, welcome them into your functions, accept them as fellow modelers and forgive their businesslike attitude. I think you'll find that you've placed yourself and your club in a win/win situation! The alternative is to make coexistence so uncomfortable that you lose not only a fellow modeler, but a staunch supporter as well.

Boy, how time flies. Another month and another column closer to Top Gun. Don't forget that Tom has promised the most extensive coverage yet, so don't you dare let that subscription expire! As of the last tally, we have two pilots from West Germany entered, one each from France and Brazil and a couple from England. As for my team-scale entry with "professor" Don Smith, we've got a 1/5-scale LA-7 just about ready to test-fly! Until next time, remember that putting larger airwheels on your airplane won't make it lighter. Your six is clear.

Bob Violett shows the guys how and where he puts all the gizmos for the new T-bird. Sure makes everything a lot easier when you've got a hatch big enough to put your entire hand in!

**Here's the address of the company that's pertinent to this article:*
IPMS Color Guide, David Klaus *P.O. Box 47110, Washington, D.C. 20050-7110.* ■

HOW TO

Form Giant-Scale Canopies

It's easier than you think

by JERRY NELSON

There's more than one way to make a plastic canopy for a giant-scale model. The methods include vacu-forming with a male or female mold, free-forming with pressure or a vacuum, and stretch-forming. Vacu-forming and free-forming require tools that most modelers wouldn't have. To stretch-form a canopy, plastic, usually butyrate or vinyl, is heated in an oven, usually at a temperature of about 300 degrees Fahrenheit. (The temperature will vary depending on the type and thickness of plastic you use.) When it's hot enough, it's removed from the oven and stretched over a mold.

Most canopies that are supplied in model kits are vacu-formed over a male mold. From the manufacturer's point of view, this is the best method because it's inexpensive and it saves time, but it does have a drawback: as the mold sets, the material becomes thinner at the base of the canopy. The top will be about as thick as the plastic, but the base can be less than 25 percent of that thickness. A thin base can be a problem when it's time to attach the canopy to the fuselage or the canopy frame, so thicker material must to be used to provide the necessary minimum thickness. Stretch-forming can result in the opposite problem (normal base, thin on top), but that's better for model use.

If you want to make a canopy for a single model, stretch-forming is the simplest. The quality of your canopy will depend on the condition and rigidity of the mold and the cleanliness of the plastic sheet before you melt it.

The canopy shown in this article is one for my 1/3-scale, prototype, all-aluminum AL-1. For your reference, the AL-1 has a fuselage length of 72 inches, a span of 97 inches and an empty weight of 28 pounds.

MATERIAL

Butyrate sheet, which is often used for model canopies, isn't usually available in the size and thickness that's required for large canopies. It's also quite expensive, especially if the canopy you plan to build is a high, narrow "deep-draw" canopy, for which .062-inch-thick material is sometimes required. A .062-inch-thick, 24x24-inch butyrate sheet can cost $20.

You can also use Plexiglas, but it's expensive, too, and you can't obtain it thinner than 1/16 inch. It's very strong, but it's somewhat brittle and difficult to cut properly.

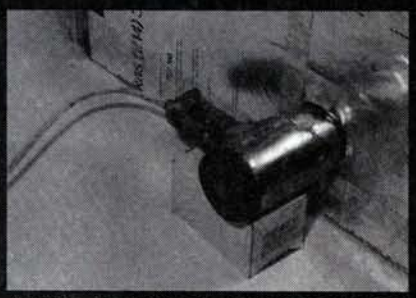
Vinyl is readily available (just check your Yellow Pages under plastics), much less expensive and it forms at a lower temperature. It's easy to cut, and it's available in several thicknesses. Its disadvantages are that it isn't as strong as butyrate and, if you plan to glue the canopy to something, there may be an adhesion problem. I used .040-inch-thick vinyl for the AL-1 canopy, with excellent results.

The size of the material you use will obviously be determined by the size of the canopy. You'll need about 4 inches of extra material to attach the plastic to the forming blocks and to allow for trimming. The AL-1 canopy material measured 24x22 inches.

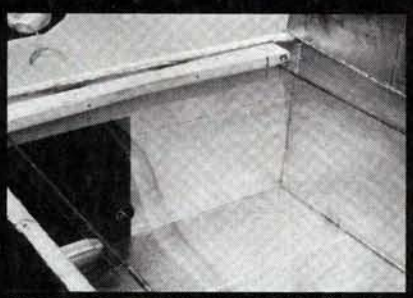
CANOPY MOLD

You can use many materials to make your mold. Hard materials are more durable, but if you only plan to make a few canopies, then softer materials are OK.

Balsa wood is fine, but it's expensive. Pine is good if you have a large band saw



A hobby or modeling heat gun is used to heat the oven box.



The plastic sheet is supported by 3/16-inch-diameter aluminum tubes that are located near the top of the box.

The simple oven box is built of 1-inch-thick, foil-covered, insulation board. It's held together by 3-inch nails and fiberglass strapping tape.

Giant-Scale Canopies

and a belt or disk sander. I used 2-inch-thick blue Styrofoam insulation material that I bought at a local hardware store. A big sheet costs about $10. Glue the 2-inch sheets together with spray-on contact cement to make a block of a size that suits your needs.

"Rough" the canopy into shape using a carpenter's saw, and then make smaller cuts with a hacksaw. Contour the mold into its final shape using 40-grit sandpaper.

The accuracy of the canopy outline isn't critical because it doesn't usually have to match a particular bulkhead or former exactly. You can stretch the canopy a little to fit the bulkhead.

One problem I encountered when I made the canopy mold for the AL-1 was making the front of the canopy fit the front canopy support bow. The mold was cut to fit exactly behind the support bow, and I shaped the top contour to fit the contour of the front canopy exactly. I traced the support bow outline onto the front of the Styrofoam mold with an ink marker to use as a guide when I formed the canopy.

The front of the AL-1 canopy is also made from .040-inch-thick vinyl. It's wrapped around using flat sheet, so no mold is necessary. It's better to have the front portion separate from the main part of the canopy. The forming process is much easier, since there's only a little stretching required to form to the top outline contour. The AL-1 canopy opens anyway so that I can access the electronics and join the wing to the fuselage.

I added foam blocks to the front and bottom of the mold to allow for easier forming of the plastic. Sand the Styrofoam mold to shape, and outline the intersections of the added blocks with an ink marker. (This outline will help when you have to trim the canopy later.)

After you've sanded the mold, add a 2-inch foam block that's about 1/2-inch narrower than the bottom of the mold to the bottom of the mold. This will help in the stretching process.

Now cover the mold with fiberglass cloth and epoxy resin. (You must use epoxy resin, because polyester resin will dissolve the Styrofoam.) Which weight of fiberglass you use isn't too critical. I used about three layers of .008-inch-thick (medium-weight) material in the AL-1 mold. Add enough epoxy to allow you to sand the mold without sanding into the fiberglass. You may have to add more epoxy later to obtain a smooth surface. The canopy outlines you made with the ink marker will show through the fiberglass cloth. Take as much time as you need to produce a very smooth mold. Irregularities that you leave in the mold may show up in the finished canopy.

OVEN CONSTRUCTION

A kitchen oven wasn't big enough, so I built a simple oven box out of 1-inch-thick, aluminum-foil-backed, insulation foam. You can obtain the foam at any building supply center.

Make the oven about 2 inches bigger than the flat canopy dimensions and about 12 inches deep. Use a carpenter's saw to cut the insulation foam, and pin the pieces of the box into position with 3-inch nails. Reinforce the nails with fiberglass strapping tape. Make sure that the top of the box is removable.

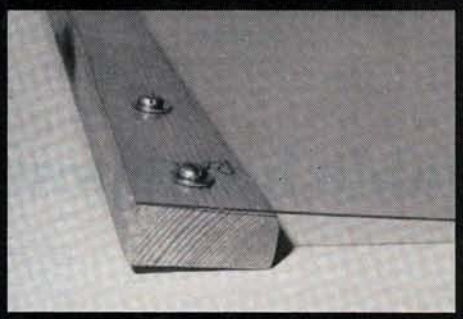
Place two 3/16-inch to 3/8-inch-diameter metal tubes or rods near the top of the box to hold the plastic sheet in position as it heats.

Use a heat gun (for heat-shrinking model-covering material) as the heat source. Cut a hole in a side of the oven box near the bottom, and press-fit the heat gun into place.

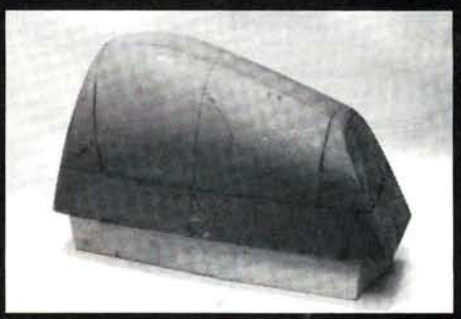
FORMING SUPPORTS

From 1-inch-thick pine, cut two 2-inch-wide, 22-inch-long forming supports to the top shape of the canopy. The sides of the AL-1 canopy are parallel to the front of the fuselage turtle deck, and they taper to the rear of the fuselage. I duplicated this shape when I made the pine forming supports. When the plastic is stretched over the mold, it's easier to form the plastic around the mold with the forming supports. The mating edges of the forming supports have a generous radius to prevent the plastic from being cut during the stretching process.

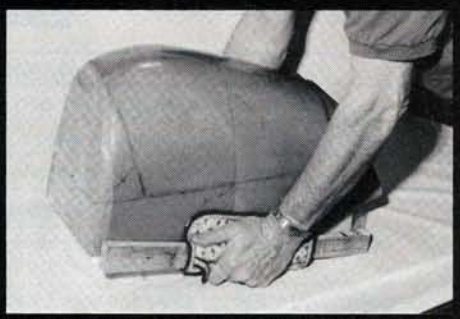
Screw the plastic sheet to the forming supports with several no. 8 or no. 10 wood



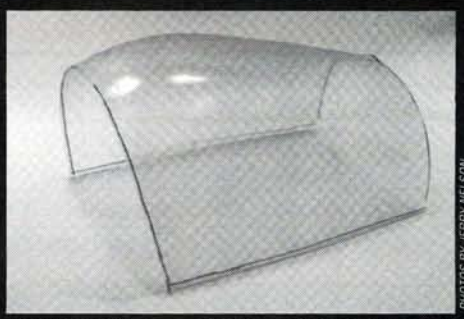
Attach wooden strips to the vinyl with screws and washers so that you can have a firm grip on it as you form it.



It's easy to make the male canopy mold out of layers of 2-inch-thick sheets of blue Styrofoam. Cover the plug with three layers of fiberglass cloth and epoxy resin.



When the plastic is soft enough to sag in the middle, remove it from the oven and pull it over the plug (apply even pressure to both sides). Keep the plug close to the oven; the plastic cools very quickly. Use oven mitts!



After the plastic has cooled, use an ink marker to mark the trim lines. Cut the canopy with large scissors or tin snips for an accurate fit.

PHOTOS BY JERRY NELSON

screws and large washers. For extra insurance, screw another 1/4-inch- to 1/2-inch-thick forming support on top of the plastic into the main forming supports. This would prevent the plastic from tearing away from the screws as you stretch it. (This usually occurs when the plastic isn't hot enough and too much force is used to stretch the plastic.)

The plastic will pick up a static charge as you work on it. To eliminate the charge and remove all the scrap particles that will accumulate on the plastic, wipe it with a cleaner such as Windex.

STRETCHING PROCESS

Place the plastic sheet and the forming supports on top of the metal support rods in the oven box, close the lid and turn on the heat gun. In 5 to 8 minutes, when the plastic sheet softens and sags noticeably below the support rods, remove the plastic from the oven box. The time may vary, so just watch for the plastic to sag.

Put on oven mitts—it's hot!—grab the support frames, quickly remove the plastic from the oven box and stretch the plastic over the mold. The plastic cools quickly, so keep the mold handy. Stretch the plastic just enough to let it form properly over the mold. If the plastic feels like a rubber sheet and you *can't* stretch it, then it isn't hot enough.

You might want to keep the forming supports level so they match the contour of the canopy base. You won't need to use too much force if the plastic is hot enough. Hold the forming supports against the side of the mold for a minute or so, until the plastic cools.

If something goes wrong as you stretch the plastic, don't worry. You can put the plastic back into the oven and reheat it. It has a 100-percent memory; it will return to its original, flat condition when you reheat it. Mold at least three canopies: one in case of a trimming mistake, the other as a spare in case you need to repair the aircraft.

CUTTING THE CANOPY

Place the uncut canopy back on the mold. With an ink marker, mark the edges of the canopy as shown under the fiberglass covering. If you use vinyl, you can remove the ink with acetone later.

Use large scissors or tin snips to cut off the excess plastic. Cut it larger than necessary to allow for trimming the fuselage or canopy frame later.

In the next issue, I'll explain how to attach the canopy to a model.

MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

JACK OF ALL TRADES

Jade Impulse

by ED SLEGERS

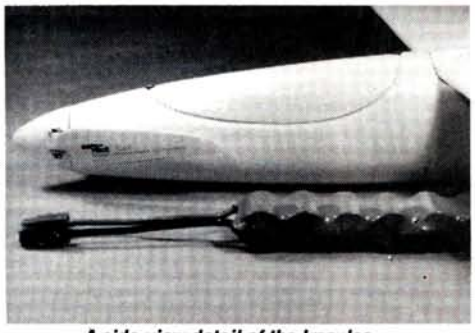
AFTER MORE than 30 years of building and flying model airplanes, I'm still amazed by all the new products that keep coming out to improve our hobby and make it more enjoyable. The things that I remember most include proportional radios, servo-reversing, heat-shrink covering, CA, composite building material and computerized radios. There are a thousand other things that I now take for granted, such as those little accessories that fall into the "I wish I had thought of that" or "I wish they had offered that last year" categories. Just when I thought no one could possibly offer anything truly new, along came the JADE* Impulse.

I first saw the prototype Impulse at the 1991 WRAM Show. Sal and Stan of Northeast Sailplanes had invited me to display a few of the sailplanes that I had converted to electric to see how the public would react to them. The prototype Impulse was also on display to determine whether there was enough interest to justify manufacturing a kit. The electric conversions and the Impulse received many positive remarks.

PHOTOS BY STEVE SCHULMAN

Greg Porter holds the Impulse

Impulse



A side-view detail of the Impulse.

Because I'm partial to vee-tails and I'm always looking for a new plane to convert to electric, I began to study the Impulse. I soon saw that it had great possibilities. After the show, I talked Sal and Stan into letting me take the Impulse home. (This wasn't easy; they wanted the plane, too!)

I took it home, installed the radio and, a few days later, flew it. Because the first flights were made on a small slope that didn't really have a good grade, they were more like hand-launching than slope soaring. Still, the slope was good enough for me to set the travels properly and determine the CG. This prototype plane didn't come with plans or instructions, so trimming was done mostly by trial and error.

I got tired of hand-launching the Impulse, so I installed a tow hook and tried launching it with a winch. With some altitude, the Impulse showed how good it really is. It can perform aerobatics, yet can be slowed down enough to thermal. There may be better slope planes and better thermal planes but, with the Impulse, you can have fun doing both, and that's hard to beat. You can also convert it to electric.

After I had learned how the plane handled, it was time to try an electric conversion. I cut off its nose and installed a firewall, an Astro Flight* FAI 05 motor, a Novak* speed controller and a 7-cell 900mAh SCR battery pack. It was back to the field for some test flights, all of which went well.

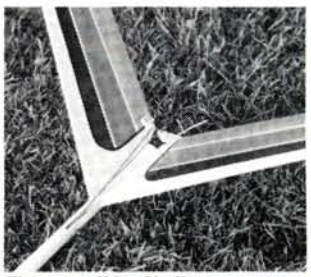
In about 20 seconds, the Impulse can fly about as high as you'd want it to. Even with the higher wing loading, it can still thermal and perform aerobatics, although it lands just a little faster. I prefer the electric version. There's no more hand-launching and no heavy winch to carry; just charge a battery pack or two, and you're ready to fly.

THE KIT

JADE owner Richard Jarel designed the Impulse, and he now manufactures it. It features a vee-tail, a pod-and-boom fuselage, and balsa-covered white-foam wings with built-in washout. Its fuselage is made of a unique material called CrashGuard—a thermoplastic "alloy." This isn't like the thin plastic found in some ARFs. It's an extremely strong space-age material; so strong, in fact, that JADE will replace the fuselage parts for $10 if, for whatever reason, the fuselage becomes unusable. (Note: the fuselage must be returned in the original box, and there are no exceptions to this.)

Construction of the wing and tail assembly is pretty basic, but there are some different building techniques used to assemble the fuselage. Also, the electric version is built differently from the non-powered version.

There were two unusual things in the manual. First, it states that JADE recycles all the scrap material that's returned to the company—a good idea. Second, the manual lists several warnings.



The vee-tail is of built-up construction. The stabs are fitted into slots in the tail boom.

SPECIFICATIONS

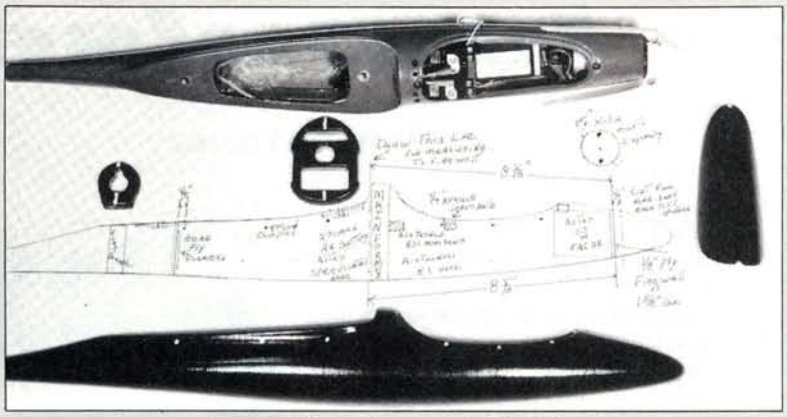
Model name: Impulse
Type: slope, thermal, winch, or electric
Wingspan: 74.5 inches
Wing area: 550 square inches
Weight: 38 ounces
Wing loading: 10 ounces per square foot (and up)
Length: 40 inches
Airfoils: modified SD6060 and S3021
Channels req'd: two for slope and thermal (aileron and elevator); three for electric (aileron, elevator, throttle). Use a computer radio if you want to mix functions.
Power req'd: winch or slope launch, or FAI 05 cobalt with a 7-cell SCR 1200mAh or 900mAh packs. (A speed controller is optional.)
Prop: 9.5x5 Freudenthaler (recommended)
Wing construction: sheeted foam with an aspect ratio of 10:1
Washout: built-in
Kit construction: thermoplastic-"alloy" fuselage
Price: $79.95
Features: this plane is designed to be flown in electric-powered or non-powered versions. The CrashGuard thermoplastic fuselage will be replaced for $10 (for any reason) if the damaged fuse is returned in the original box. Pre-shaped hardwood leading edges, complete hardware package and instruction book with photos and illustrations are included.

Hits

- good all-around flier that goes together well
- inexpensive; building multiple versions is affordable
- great fuselage-replacement guarantee
- well-done construction manual with lots of pictures

Misses

- One hit is also a miss; because it's a versatile, all-around flier, it can't perform in any one role as well as a dedicated design.
- The early production kit had vague instructions for electric installation. (The manufacturer states that revised electric instructions are now included.)



A detail of the suggested motor installation.

GOING ELECTRIC

BY GORDY STAHL

Building the electric version of the Impulse deserves some care. Here's how I did it (including key incidences and space relationships).

Before you start to build, cut out the two plywood formers. Use them to mark sanding references inside the fuselage halves. Next, cut out the canopy, mark its fore and aft center, and transfer those marks to the outside of each fuselage half where the canopy sits. (Note: cut the canopy sides just outside the lines; the length is perfect.).

Here's a trick: put one half of the fuselage on a sheet of paper and trace around it. Use a ruler to find and mark the vertical center line of all the formers in the fuselage, i.e., where each former meets the top and bottom inside surface of each fuselage half. For example, lay a straightedge along the vertical line made by the main former at the leading edge of the wing saddle, and extend that line down through the fuselage silhouette. Use this base line to measure the distances between the ply formers and, most important, the distance to the motor former and its incidence alignment. (See the photo.) Now you can put the fuselage half back on the drawing and transfer the reference marks onto the half. By holding the halves together, you can also transfer the marks to the other half.

Find the three mold "dimples" along and just below the wing saddles of each fuselage half. Use the rear dimple as a guide to position the rear ply former. The balsa side doublers mentioned in the instructions should stop at this dimple.

The main former (between the wing saddle and the canopy) and the tail end of the fuselage are used to determine the incidence of the tail feathers with the wing. The electric version uses an additional, smaller 1/8-inch plywood former that supports the boom further back. This aft ply former takes over the job of the main former in determining the incidence of the tail feathers.

I found it easier to make two of these formers. The one that fits in the fuselage (cut just outside the lines of the drawn sample) is the one that will be glued to the fuselage. It should have an oversize boom-tube hole cut into it to allow some alignment movement of the boom.

Version no. 2 of this former's outside perimeter needs to be at least 1/8 inch smaller in each dimension, but the boom-tube hole in this former should be a snug fit for the boom. After the fuselage has been completely assembled (and the first, aft plywood former glued 1/4 inch behind the rear fuselage mold dimples), slide the boom into the rear of the fuselage and through that ply former. Slide the smaller former (version no. 2) onto the boom tube, and then slide the boom-tube forward into the main former. Use the main former as your alignment fixture, as it was intended in the non-electric version of the Impulse.

Tack the smaller version against the original ply former with a little CA. (Don't let the CA get onto the boom-tube.) The boom alignment and incidence should now be perfect. More glue can be added to the (now doubled) ply former when you're ready to install the tail section. At this time, it's best to cut out the middle of the main former to create an opening through which you can route the aileron wires forward to the receiver.

Cut the boom tube last. After you've installed all the gear and glued the tail assembly to the boom-tube, slide the boom tube in until you get the CG right. Be sure to attach the cable, horns, etc., to the tail section before you do the balancing.

Here are two more tips. Use a four-point servo arm on the wing servos, because you need the extra arm length to extend out of the servo bay. The Impulse flies fine with the vee-tail set up as elevator only.

You'll love this plane, and you'll probably build a few versions of it. The kit comes loaded with goodies and innovations. If you have any questions, feel free to contact me at 6623 W. Chambers, Milwaukee, WI 53210; (414) 873-5842.

I guess product liability has finally reached the model industry—too bad.

CONSTRUCTION

The tail feathers are made of built-up balsa and spruce, and the wing is balsa-covered white foam. Follow the instructions, or use the method you're most familiar with. I like to use Weston Aerodesign's* West System to vacuum bag the wings, and I cut the servo-wire holes and servo cutouts before sheeting. I also put a square piece of fiberglass over the servo cutout on the inner side of the upper sheeting for added strength.

In the sailplane version, a 5/8-inch aluminum boom runs from the tail through the aft fuselage former and up to the front fuselage former. On the electric version, the front end of the boom is shortened to fit against a rear ply former that's mounted an inch or two in front of the trailing edge. This creates the bat-

Here, Ed Slegers and Gordy Stahl share their comments on the flight performance of the electric Impulse. Ed likes an intense blast of power from his drive system (as in F3E), which replaces a winch or a high-start. Gordy likes enough power to climb to altitude and some reserve power for cruising.

- **Takeoff and landing**

Stahl: You can toss the Impulse into the air like any electric; it will pull away from your hand, so you don't have to hurl it. My Impulse, which was built without dihedral, climbed out with great stability.

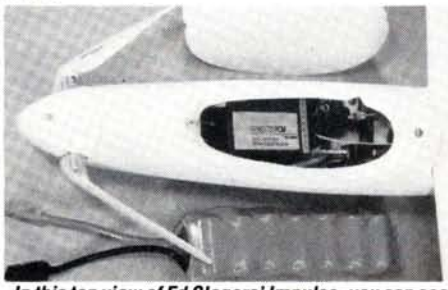
Although designer Rich Jarel recommends an FAI 05 cobalt with 7 cells and a 9x5 Freudenthaler folding prop, I used a standard 05 cobalt running on 7 cells with a microswitch. With the recommended prop, this less powerful motor pulled approximately 40 amps and caused the plane to run out of power fairly quickly. I switched to a Graupner* 7x7 non-folder (which was all I had with me), and the plane performed well. It climbed out at almost a 30-degree angle and easily achieved an altitude of several hundred feet.

I noticed that I had to watch the

Impulse

tery compartment. The recommended adhesive is Pacer* Poly-Zap, although the green Zap-a-Gap is also good. *Don't use an accelerator,* because it tends to make the glue joint more brittle.

Cover the wing and stab with your choice of covering material. (I used MonoKote*.) The fuselage comes in your choice of either black or white.



In this top view of Ed Slegers' Impulse, you can see the ship's low-drag contours.

Install your radio equipment according to the instructions. The recommended travel throws in the manual are very close.

I've had a lot of fun with the Impulse. There aren't many $79.95 planes that can function so well in so many roles. (And there aren't many companies that offer a replacement fuselage for $10 if you break the stock one.) For $40, you can buy a spare fuselage, build another tail and use one wing with both a powered and a non-powered version. That's what I've done, and it works extremely well. If you're looking for an aileron electric sailplane that flies fast, try the Impulse.

**Here are the addresses of the companies mentioned in this article:*
JADE, *12136 Braddock Dr., Culver City, CA 90230.*
Astro Flight Inc., *13311 Beach Ave., Marina Del Rey, CA 90292.*
Novak Electronics Inc., *128-C E. Dyer Rd., Santa Ana, CA 92707.*
Weston Aerodesign, *944 Placid Ct., Arnold, MD 21012.*
Pacer Technology and Research, *9420 Santa Anita Ave., Rancho Cucamonga, CA 91730.*
MonoKote/Great Planes Model Distributors, *P.O. Box 9021, Champaign, IL 61826.*
Graupner; *distributed by Hobby Lobby International, 5614 Franklin Pike Cr., Brentwood, TN 37027.*

FLIGHT PERFORMANCE

plane closely during the second climb-out in a flight to keep it from stalling when the motor power dropped. The stall happened unexpectedly because the plane typically climbed at a steeper angle than conventional electric-powered gliders. Instead of a sudden tip-stall or a snap, it just rolled over. It was easy to recover; I just gave it opposite aileron as it swooped down. This behavior didn't occur during landing approaches.

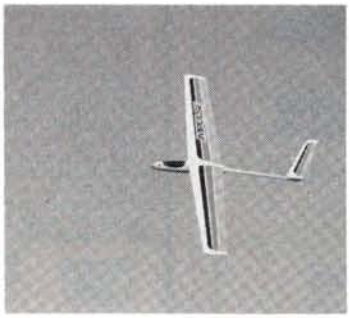
Landings are fast because this machine is very clean. I found that I had to be attentive because a little elevator caused the plane to gain altitude surprisingly quickly.

Slegers: When I convert a sailplane to electric power, I want to be able to put it in the back of the car, go to a flying field, chuck it into the air, fly it as a sailplane, land it and go home. I want to avoid the inconvenience of using a winch or a high-start. A short motor run of a minute and a half of usable power is just right for me.

I used the recommended power system and prop and put in about 1.5 inches of dihedral at one tip of the wing, i.e., with the other flat on the building board. Although the Impulse isn't a floater, the dihedral makes it a little tamer. On landing, the Impulse came in a little faster than a Graupner Electro-Uhu.

- **High-speed performance**

Stahl: This is a very streamlined, fast-flying electric (at 4 pounds, mine has a wing loading of 16.76 ounces per square foot). When flying on high throttle, I had to hold a little down-elevator to keep on a level track. I've made this plane dive from several hundred feet and never experienced flutter.



Slegers: To avoid the need for down-trim, I gave the motor about 2.5 degrees of downthrust. This eliminates the ballooning tendency when you add throttle. When converting a glider to electric, I always start with about 2 degrees of downthrust (the higher the lift of the airfoil, the greater the downthrust) and then find out what works best in the air.

- **Low-speed performance**

Neither electric version was tested in low-speed flight.

- **Aerobatics**

Stahl: To test the strength of the wings (I had epoxied an optional layer of 2-ounce glass under the balsa sheeting), I put the plane in a 45-degree-angle dive from about 300 feet and violently pulled up as the plane approached the ground. It zoomed right back up, retaining energy like no glider I've ever flown. Jarel advises that the stiffer you make the wings, the better it holds energy in this type of maneuver.

On full throttle, the Impulse rolls as fast (or faster) than a typical .40-size glow-powered plane. Without dihedral, no elevator input is necessary for axial rolls. Inverted flight required more down-elevator than was stated in the instructions for the non-electric version.

If you use a speed controller, it's best to use one with a break for the prop, e.g., an Astro 205. My usable run time with 1200mAh Sanyo SCRs has been more than 3 minutes. To reduce the wing loading, use 900mAh SCRs. If you're not used to rocket ships, you must stay on it at all times; if you just want to have fun, building in a little dihedral is advisable.

Slegers: With its slope-soaring capabilities, the Impulse is very aerobatic. It does loops and rolls and flies inverted well. I recommend a differential aileron throw of 50-percent down. This helps to smooth out the turns, reduces the chances of a stall and is generally more important in vee-tail ships. Because of the vee-tail, there's a slight tail waggle during high-speed passes.

G-23

(Continued from page 50)

slowly. The original engine was later replaced by a stock Zenoah G-23. This gave me faster takeoffs, better climb rates and better power for zoom-up-style maneuvers. After installing the Hanson cylinder, carb and ignition module, the flying just got better! Now it goes straight up a lot farther and climbs to spinning altitude faster. I pull larger loops and have greater authority during aerobatics. Maneuvers that require a lot of up-front-pull, like a respectable outside loop and good knife-edge flight, look good now; they weren't possible before. But the *real* plus is that my Cub is now a whole bunch more fun to fly!

**Here's the address of the company featured in this article:*
***B.H. Hanson Co.—Model Marine Products,** 2228 S. El Camino Real, Suite 123, San Mateo, CA 94403-1853; (415) 345-5592.*

FAI

(Continued from page 57)

style. Somenzini is having a similar breakthrough, but is going further forward and creating a new style that will undoubtedly become the standard. Hyde will have to work doubly hard to repeat his victory next time in Austria,

and I bet that his two most serious competitors will be Prettner (again) and Somenzini.

The bronze medal went to von Linsowe, who was nearly unknown outside the U.S. At the last Tournament of Champions, he flew quite convincingly. Since then, he qualified in the U.S. team in second place, which was a remarkable feat indeed. He used the largest model at the Championships, and with this model, the USA Star, he flew in a very smooth style, at a very moderate speed and with plenty of power to pull the enormous aircraft through the verticals. This quiet pilot could well challenge Hyde for top places.

BIGGER, MORE POWERFUL, SLOWER

Where is F3A going? The models are becoming larger again, and I wonder if this is a growing trend (like Peter Erang's Matador 2 or von Linsowe's USA Star). With 4-stroke engines, a lack of power won't be a problem, and these

(Continued on page 85)

ENGINES ALOFT

BOB GILBERT

FOX .50 BB

A LOT OF us do it—take the engine out of the box, screw it into the airplane and go flying. Is that OK? Will it work?

Not too many years ago, this wasn't advisable. The engines just weren't good enough. But things have changed, and the Fox* instructions state, "Your Fox .45 or .50 has been test-run at full power and should fly your airplane with no problem." So that's just about the approach I took—with minor deviations.

I started by weighing the engine and comparing it with its advertised weight. I got 13 ounces for the bare engine, while the manufacturer's specs said 12. No big deal. The shiny spinner and backplate add 1.4 ounces, and the muffler weighs a mere 2.3 ounces. The only tool supplied with the engine is a hex wrench that's required for the muffler. A glow plug was supplied installed. Though a Fox will never win any awards for being the best-looking engine on the market, this example isn't what I'd call ugly, either. To me, it's a functional piece of machinery, and it does its job very well. Read on.

I was impressed with a small tag on the crankshaft that states, "This motor-check run and approved for sale by Jerry Whitlock." I liked that personal touch. The paperwork that accompanied the engine included the basic owners' manual, two sheets of upgraded instructions, a parts-ordering list and an eight-page catalogue of Fox products. One point that's driven home in this paperwork is that Fox recommends the use of a minimum of 17-percent castor oil as a lubricant. To my 5-percent-nitro fuel, I added castor oil to meet this requirement for the first few runs.

My good old Florio* 40 was again called on to act as a test bed for the flight testing. The installed weight of the combination came to 4 pounds, 12 ounces.

SOUND-LEVEL TESTS

All sound-level tests in this column, starting with this test, will be accomplished in the following manner and are performed to give the reader a rough idea of what might be expected from the engine in question.

You may well expect that you'll obtain higher or lower readings if you perform a similar test. The test instrument is a Radio Shack sound-level meter (no. 33-2050). It's set at "A" weighting and "slow" for response, and it's held at about waist height throughout the test. The readings are taken at approximately a 9-foot circle around the airplane or test stand. No corrections for temperature, humidity or reflections from nearby objects are made. The highest reading in decibels (dB) will be given.

As we have regulations regarding maximum allowable sound levels at my flying field, the first thing I did was to run the engine to test the dB level. Using a Graupner* 11x6, and running it only up to 11,200rpm, I got 94dB, which is too loud for our field. To quiet things, I installed a PST muffler, which was sold in the past by Hobby Lobby, but is no longer listed in their catalogue. This muffler appeared to be a little too small for the .50, but it was the best I had at the time. It was quiet enough—only 83 dB—but on the same prop, the rpm dropped to 9,200.

ON THE QUESTION OF NOISE!

The owners' manual advises the operator to "Be quiet" and advises that you add a "hush kit" if there's any possibility of annoying someone. But neither the catalogue nor the parts list reflect the availability of such an item. The muffler supplied is of little more value than a header, and almost any kind of aftermarket muffler of a suitable size should help quiet things. An aftermarket muffler of a reasonable size shouldn't slow the engine more than 300rpm (not the 2,000rpm drop that I experienced using an undersize unit). I was surprised that the engine didn't overheat with all that exhaust restriction. Possibly, the cool ambient temperature saved the day.

Even though the instructions are adamant about the use of all-castor-oil lube in the fuel, the only 10 percent available for the test was my Byron* Premium Sport fuel. This type of blend is specifically advised *against* in the updated instructions. According to the instructions, its use might possibly shorten the life of the engine somewhat, but it didn't seem to affect its performance in any way. I know of many fliers who operate all kinds of engine on a blend, with no ill effects.

BENCH-TEST RESULTS

APC* Prop	Max rpm	Max dB	Min idle rpm
12x6	10,800	96	—
11x7	12,200	95	2,900
11x6	12,400	97	2,900
10x10	10,300	96	—
10x9	11,100	95	—
10x6	13,600	98	3,100

Now, with a very quiet engine, off to the field I go, to get a little air time. As the engine is still new, I'll stay with the 5-percent fuel with added castor oil.

This trip is made in great haste, as I'm well aware of a front moving in our direction and expect wind and/or rain before long. When I arrive, it's calm, and the temperature is about 40 degrees F.

The instructions warn me that the engine might not idle too well until it has some time on it, but this doesn't seem to be a problem. I set the engine a little on the rich side, point the nose up at full throttle to check the carburetor setting, then taxi out to the runway.

Then I advance the throttle. The throttle response is very poor. It eventually revs up and the plane takes off—gracefully, but not like a rocket. Why should it? I've effectively reduced its power by putting on an undersize muffler. The engine runs consistently well, and the airplane performs as I expect. I put two more short flights on the plane before the rain moves in on me—along with the wind that had been promised.

During my drive home, I contemplate the next steps to take to prove this engine. It has already proven itself with regard to being able to go from the box directly into the airplane. Owing to the restrictive muffler and the 5-percent fuel's being overloaded with oil, I know that there's lots of power waiting to be discovered. I feel that the only way to complete the tests is on the bench.

Now, just look at those test results in the performance!—very impressive, I think. The throttle response with the stock muffler was excellent, and vibration levels were reasonable. My test stand allows replication of the nose-up condition of an engine installed in an airplane, and that allows testing of the fuel-draw capability. It passed that test with flying colors. After a few runs, hand-starting the warm engine was very easy.

What's my overall evaluation? The Fox .50 is a well-made engine—one of the best in this price range. It's very powerful, and even with the additional cost of a good muffler, it will set you back a whole lot less than many of the imports. It's a little on the heavy side, however, especially with that added muffler thrown in. Though I haven't had any experience with the Fox service department, I've heard from others who have had good experiences. A phone number for the factory is in the instructions and, though the instructions don't mention a specific guarantee, the Fox repair policy sounds very reasonable to me. And remember, this product is made right here in the United States of America!

Well, that does it for this month, but let's look to the future. I welcome your comments and questions, and I'll try to answer you directly so that you don't have to wait for the next issue.

**Here are the addresses of the companies mentioned in this article:*

***Fox Mfg. Co.,** 5305 Towson Ave., Fort Smith, AR 72901.*

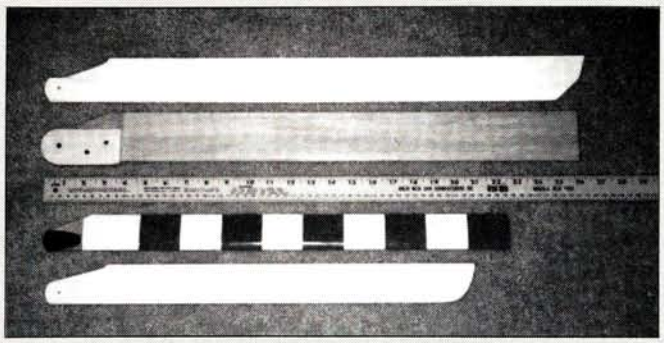
***Florio Flyer Corp.,** 837 Johnsonburg Rd., St. Mary's, PA 15831.*

***Graupner;** distributed by Hobby Lobby International, 5614 Franklin Pike Cr., Brentwood, TN 37027.*

***Byron Originals,** P.O. Box 279, Ida Grove, IA 51445.*

***APC;** manufactured by Landing Products, P.O. Box 938, Knights Landing, CA 95645.*

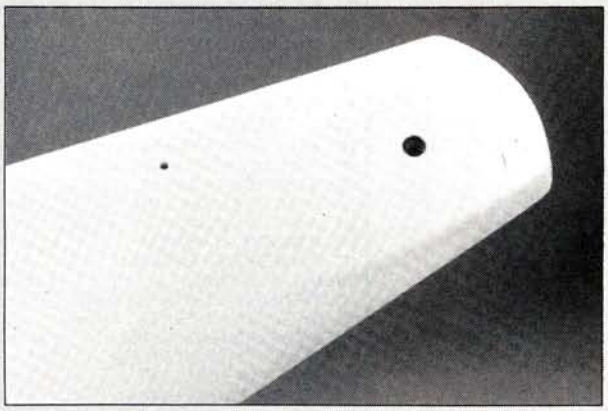
PRODUCT REVIEW



From top to bottom: .60-size Yellow Aircraft blade, Stock X-Cell .60 blade (wooden), Stock .30-size blade (striped), and .30-size Yellow Aircraft blade.

YELLOW AIRCRAFT

Carbon-Reinforced, Fiberglass Rotor Blades



Detail of the root end of the .30-size Yellow Aircraft blade.

FOR .30- TO .60-SIZE MACHINES

by CLIFF HIATT

Yellow Aircraft*, known for its high-performance jet models, now imports .30- and .60-size carbon-fiber-reinforced, pre-weighted, molded-fiberglass main rotor blades. These blades, which have a white gelcoat finish, are of symmetrical airfoil design with "swept" tips for reduced drag. The blades are shipped in a blister package that includes spacer washers.

CONSTRUCTION

The carbon-fiber-and-fiberglass composite construction provides lengthwise stiffness, even with a hollow trailing edge. The hollow trailing-edge construction and the molded-in tip weights place the longitudinal CG at about 50 percent and the chordwise CG at about 25 percent. The overall construction quality and the finish are good.

FLYING IMPRESSION

The .30-size blades provide a very stable hover with good forward flight penetration without any nose-up tendencies. The weight of these blades provides excellent energy during autorotations. Owing to their weight, I recommend that these blades be used with thrust-bearing-equipped rotor heads. The length of these blades suggests that they're intended for the Kyosho Concept 30 and the Kalt Enforcer; they're a little short for the Hirobo Shuttle.

The .60-size blades demonstrate a good hover, are very aerobatic in forward flight, and provide average energy for autorotations. They're a little light for serious contest work, but they're good overall sport rotor blades.

In summary, the Yellow Aircraft composite rotor blades offer high-quality performance for a reasonable price and should be popular with sport helicopter fliers. For more information about these blades, contact Yellow Aircraft, 203 Massachusetts Ave., Lexington, MA 02173; or Fiorenze Hobby Center, 420 W. State Rd. 434, Winter Springs, FL 32708. ■

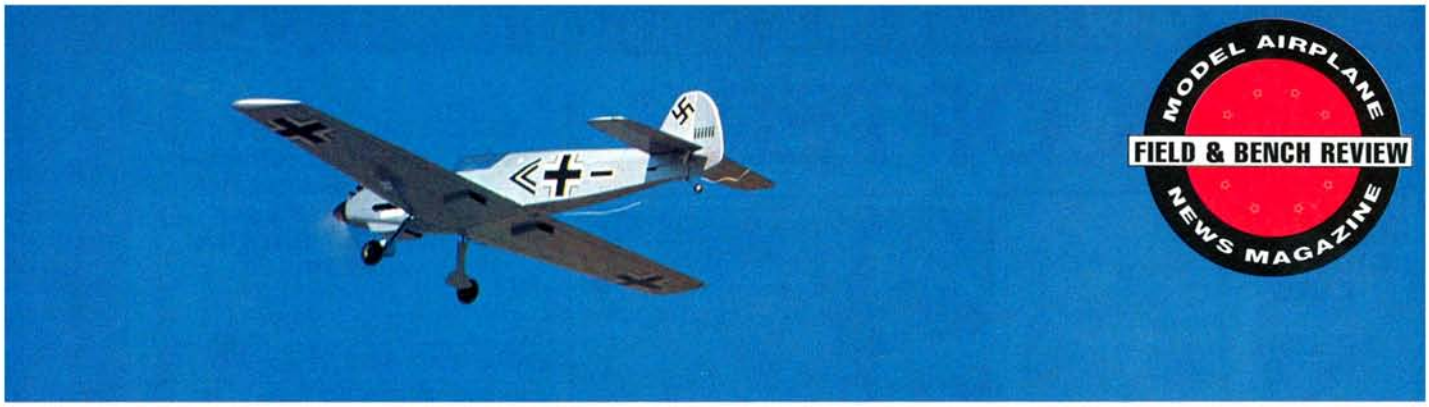
SPECIFICATIONS

Product: Carbon-reinforced fiberglass rotor blades
Importer: Yellow Aircraft
Price: $59.95 (.30-size); $89.95 (.60-size).
Blade type: Fully symmetrical, swept tip (both .30- and .60-size)

DIMENSIONS:

	.30-size	.60-size
Length (from attachment bolt to tip):	500mm	660mm
Width:	48mm	58mm
Weight:	102 grams	175 grams
Longitudinal CG:	50 percent	50 percent
Chordwise CG:	25 percent	25 percent

PHOTOS BY STEFAN KING



MODEL AIRPLANE NEWS MAGAZINE
FIELD & BENCH REVIEW

MIDWEST MESSERSCHMITT

Any flier who's looking to take a step up from a trainer or a mild sport plane to the more serious level of a low-wing tail-dragger is faced with a monumental task; the possibilities seem to be endless. It seems that everyone has a low-wing tail-dragger. It also seems that everyone claims that theirs is easy to build and docile, yet highly maneuverable. Obviously, this can't be true of every kit. We do know, however, that this claim is true for the Midwest Products* Messerschmitt.

by EARL & BOB CARPENTER

Midwest has carefully molded its image by producing high-quality kits and topping them off with excellent plans and outstanding instructions. The Messerschmitt continues to add to this approach, which builds confidence as the builder steps up to more sophisticated levels of building.

Midwest cautions that the Messerschmitt isn't intended for the first-time builder but if you can build an Aerostar, you can build this airplane.

ONE TOUGH CRASH-TESTED FIGHTER

TAB-LOCK CONSTRUCTION

The high-quality balsa included in the kit was free of warps and other defects. We followed the building sequences and instructions precisely and found no fault. Our feeling was that you could build this plane in your sleep. The kit's tab-lock construction makes it relatively easy to ensure that everything is straight and true. (You also don't need as many hands in the workshop.)

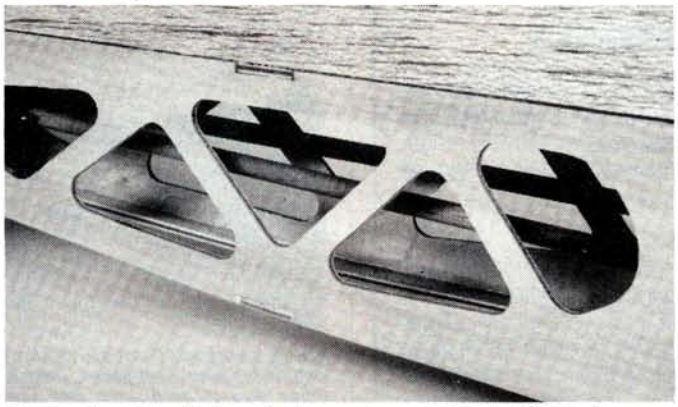
NO SHEAR WEBS?

We were curious, however, that the wing didn't include shear webs. Even the Aerostar has these, and it seems like a basic structural item that left us wondering whether the completed wing would stand up to rugged treatment. We soon found out it could, but more on that later. The fuselage is of a box-type construction with the usual doublers to add strength. The turtle deck is also built much like a box with a 1/4-inch balsa cap used to provide some meat for shaping. The construction of the kit couldn't have been much easier.

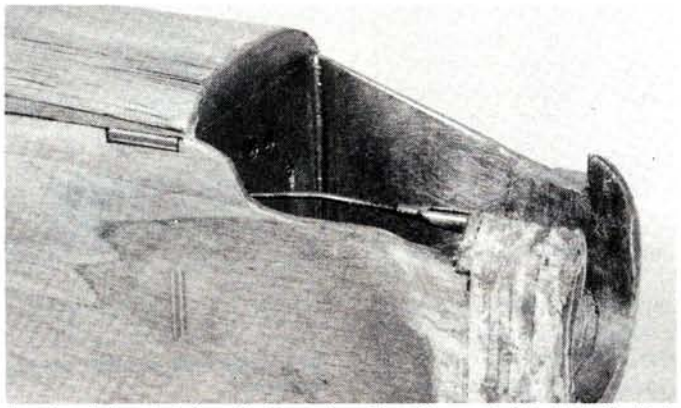
"CRASH TESTING" COMMENCES

A poorly executed landing smacked the plane pretty hard and cut our first flight short. The landing gear was damaged beyond the help of field repairs. The measly two passes we had completed gave us little indication of the Messerschmitt's handling characteristics.

Back at the workshop, we made what would prove to be a critical error in judgment: we repaired the landing gear without removing and inspecting the wing. If we had, we would have noticed that the servo tray was hanging on by a thread, so to speak. You guessed it; the next flight was abruptly terminated in a less than pleasant fashion. After a beautiful rise from the runway, the plane locked into a leftward spiral from about 40 feet up and augured into the ground with a sickening thud.



The fuselage proved to be quite strong when we subjected it to crashes.



A series of rings help form the forward section of the cowl. Note the "Tab A into Slot B" construction used where the formers are attached to the sides of the fuselage. This makes building simple.

We were more than a little surprised to see that the airplane wasn't splintered into 1,000 pieces. In fact, the only damage we noted was that the wing ripped out the bolt blocks and the fairing and there was a small dent in the leading edge of the wing. Unbelievable! Maybe the Goldberg* UltraCote or the Bob Smith Industries* glue had something to do with it. Both products have proven themselves to be very tough.

Unfortunately, we again missed another detail during our repairs. The antenna wire slipped inside the fuselage and coiled up near the receiver. You guessed it again. Our third test flight ended with an even more horrific crash. From straight and level flight at about 70 feet, the Messerschmitt did a death spiral yet again.

Observers offered us trash bags to help pick up the pieces, but the gutsy plane surprised us once more. The wing popped out of the saddle and took the bolt blocks with it (again), the servo tray broke loose (again), and there was another small dent. That's it. Period. It's hard to believe that an airplane could take this kind of abuse and fly again. So much for shear webs!

So much for our post-crash rebuilding, too. Our experiences showed us that you can't rush through a post-crash inspection and just patch up the visible damage. We know better, and we still pushed too fast to get back into the air. We definitely learned from our mistakes.

Despite ourselves, we finally had the Midwest Messerschmitt in perfect flying condition, and what a joy it was! The plane tracks down the runway with very little torque-induced deflection. We use an O.S.* .46 to power the plane and rely on a Powermaster* 11x8 prop to slow down the rpm.

This power combo proved to be a good choice. We could fly

SPECIFICATIONS

Model name: Messerschmitt
Manufacturer: Midwest Products
Type: Fun scale/warbird
Sug. price: $109.95
Wingspan: 54 inches
Wing area: 521 square inches
Wing loading: 23.7 ounces per square foot
Weight: 5 to 5 1/2 pounds
Length: 41.5 inches
No. of channels req'd: 4 (rudder, elevator, aileron, throttle)
Power req'd: .35 to.45 2-stroke; .40 to 50 4-stroke
Engine used: O.S. .46 2-stroke
Prop used: Powermaster 11x8
Airfoil type: Fully symmetrical
Wing construction: Spruce spar and built-up balsa (no shear webs)
Kit construction: Built-up ply and balsa, tab-lock construction
Washout: Not built-in
Features: all-balsa-and-ply kit with rolled plans and a 36-page construction manual complete with illustrations. Pushrods, clevises, horns, landing gear and canopy are supplied. A tank, wheels and hinges aren't included.

Hits
- Versatile high- and low-speed flier, and an appealing warbird appearance.
- Fairly good aerobatic performance, considering its fun-scale configuration
- Easy-to-build tab-lock construction and surprising durability, as evidenced by our repeated "crash tests"

Misses
- Ground steering was less responsive than we had expected.

FLIGHT PERFORMANCE

The plane was tested in zero-wind conditions. As amazed as we were by this plane's ability to withstand repeated poundings, we were also pleased with its flight characteristics. Midwest claims that it flies "like a sport plane," and it does—better than many we've flown.

- **Takeoff and landing**

On the rollout, the plane needs slight right rudder until speed picks up. Just before takeoff, you can relax the right rudder back to neutral. It's straight flying from there. Roll-out, lift off and initial climb-out are so stable that any flier with tail-dragger experience can practically duplicate a flight, time after time.

With a tail-dragger, that's an impressive feat. Still, any tail-dragger requires a defter touch and deeper concentration to get off the ground compared with a tricycle-gear plane (like Midwest's Aerostar), and that should factor into a beginner's choice. This isn't a beginner's plane.

You can land this plane almost any way you want to. Some planes require a shallow flare-out, others require high speed; the Messerschmitt, because of its decent glide and stall characteristics, can easily accommodate your preferred landing style. Three-point landings, on a practical level, were easy to accomplish. Once the plane touched down, however, we found steering to be less responsive than we had hoped. We've flown plenty of tail-draggers and, though no tail-dragger is as easy to control as a tricycle-gear airplane, the Messerschmitt consistently forced us to crank in full rudder for a few moments to effect the turn we sought. On the other hand, there was no tendency to ground-loop.

- **High-speed performance**

With throttle opened up, the plane displayed crisp performance for a sport-scale airplane. No significant trim changes were required between low- and high-speed flight. With the O.S. .46, it showed excellent vertical performance.

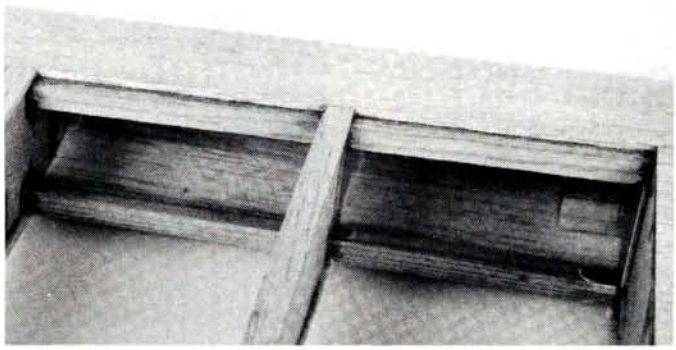
- **Low-speed performance**

The plane was very stable in low-speed flight. Gentle stalls were noted. The nose would drop but the plane would stay level without a tendency to drop a wing. Recovery was straightforward and almost hands off.

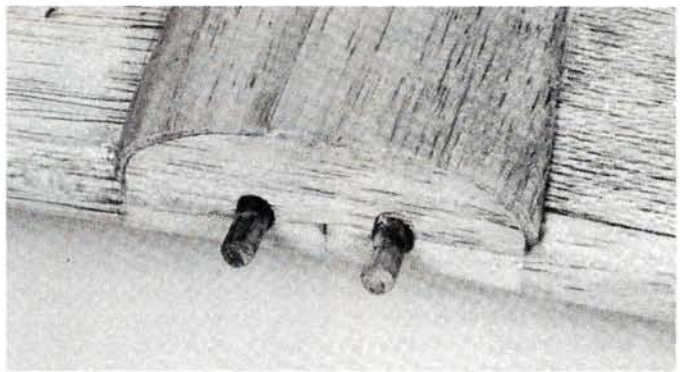
- **Aerobatics**

The plane is crisp and responsive, but its aerobatic performance can't be fairly compared with that of a sport-pattern airplane. Rolls were slightly more barrel than axial. Knife-edge flights with the O.S. .46 were fair at best, i.e., slightly mushy. If the right wing was pointing down, it wanted to roll back to the left to level flight—because of the dihedral (ours had about 4 inches at one wingtip with the other flat on the building surface).

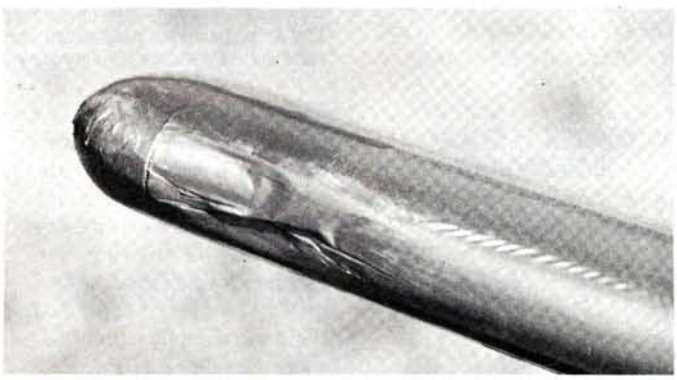
Out of a fast, diving loop, the plane could best be described as predictable: it didn't pull out to the left or to the right. Inverted flight required only a little down-elevator (barely a touch). Inside and outside loops showed no wandering to the right or to the left. Ailerons were responsive in both slow- and high-speed flight.



At first, we thought it was odd that the Midwest Messerschmitt didn't have shear webs in the wing construction. After we had stuck the plane into the ground a few times, we realized that the wing was quite strong.



Our kit contained top-quality, warp-free balsa. The dowels ensure a solid wing attachment.



The infamous dent. After two straight-in encounters with terra firma, the wing looked no worse than this. We might have to produce signed affadavits to convince anyone who wasn't there, but it's the absolute truth.

slowly and steadily when we wanted to, but we could also bore up into the sky if it seemed like the thing to do. We spent a great deal of time in inverted flight because we felt comfortable doing it. We could do flat 8s and outside loops without straying off course or panicking because of a jittery airplane (see "Flight Performance").

Despite our self-induced, fouled-up start, we've managed to rack up more than 25 flights with the Messerschmitt. It deserves heaps of praise for ease of construction and versatile flight characteristics. We also think it would make an excellent trainer for those learning sport aerobatics.

**Here are the addresses of the companies mentioned in this article:*
***Midwest Products Co.**, 400 S. Indiana St., Hobart, IN 46342.*
***Carl Goldberg Models**, 4735 W. Chicago Ave., Chicago, IL 60651.*
***Bob Smith Industries**, 8060 Morro Rd., Atascadero, CA 93422.*
***O.S. Engines**; distributed by Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826.*
***Powermaster Products**, 7807-H Telegraph Rd., Montebello, CA 90640.*

FAI

(Continued from page 75)

lightly loaded models can provide the (relatively) slow flight path and maneuvering speed that's necessary for the style that's now the trend. These planes have an enormous power-to-weight ratio, so they can perform vertical maneuvers without much initial speed and without losing speed during the rolling segments.

The 4-stroke engines' larger propellers provide more thrust (this is exactly what's needed) and brake better in the descending vertical legs. All this will be even more necessary with the new maneuvers schedule.

Notice also that Somenzini had the lightest 4-stroke-powered model (except for Christophe Paysant-Leroux, whose plane was noted for its vertical performance) and that this was a real bonus for his flight style.

It was certainly the year of the very powerful and reliable YS 120 AC engine. Six of them placed within the first 10, as well as two YS 61s, including the one in Kristensen's old Summit 3 (the one he used at the previous World Championships; he just repainted it). The new and winning Webra Competition .61 made a very good impression, both with Hyde and Erang. That engine is the only one able to really challenge the YS 61 LS, but I still think that 4-stroke engines will be even more dominant soon.

(Continued on page 90)

HOW TO

build your own

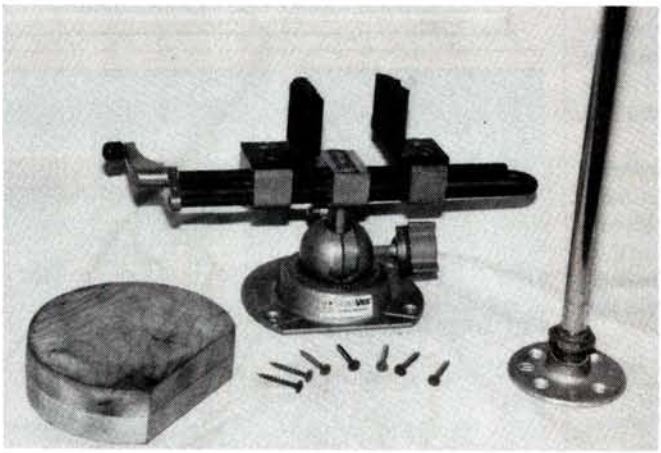
Heli Stand

by A. E. STANLEY

IF YOU'RE like me, you get a little tired of your helicopter rolling around the bench when you're working on it. Face it, if you remove the skids, your machine is less than stable—no matter *how* you prop it up on the bench. There's a solution.

Maintenance made easy

A helicopter stand fits the bill perfectly. Simply mount the machine in the stand, and you can access it from any angle. The stand can also be adjusted vertically for a standing or sitting position. To my knowledge, there are only a couple of stands available on the market today; you've probably seen them advertised. There's a problem: one is an all-around stand that isn't aimed at helicopters alone; the other is designed to hold the machine by the skids. Try taking the engine out while the skids are still on the machine!



Everything you'll need to assemble your helicopter stand is shown here.

I wanted a stand, but I wasn't willing to use one that I felt wasn't up to my needs. The solution?—I made one. After trying a few things, I came up with a very simple design that consists of a microphone stand, a Panavise, two pieces of 1x6-inch pine cut to fit the base of the vise and a pipe flange.

The materials are all readily available. I got my stand at Radio Shack for $19.95 (model no. 33-320A). I already owned the Panavise (model no. 305), but it was purchased at a hobby shop for $28.50. I picked up the pine at a building supply for $4, and the pipe flange was obtained at a hardware store for $1.25.

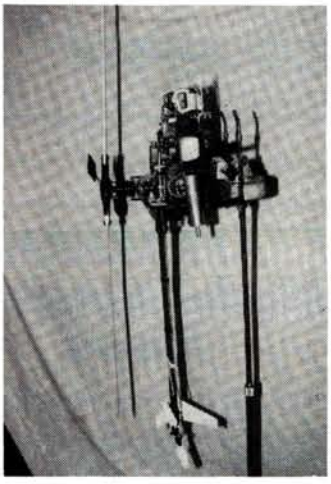
CONSTRUCTION

Assembling the stand is very easy and requires no tools. Simply screw the tube into the base and tighten the lock ring. Next, mount the pipe flange on the stand. The threads on the stand and the threads on the flange aren't the same, so I re-threaded the stand to match the flange. If you aren't able to re-thread the tube, you may choose to cross-thread the flange on the tube. Just make sure you start it straight, and this shouldn't be a problem.

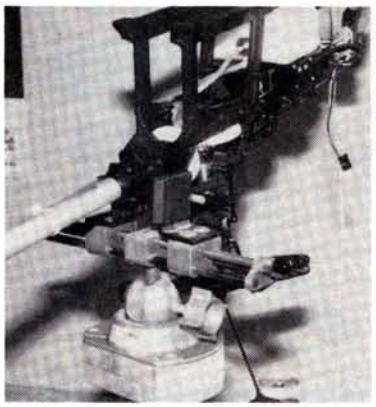
When you have the flange on the stand, cut the pine to match the base of the vise. I cut two pieces and glued them together to allow the mounting screws for the flange and vise base enough "bite." Mount the flange to the wood with 1-inch wood screws, making sure that it's centered. (It's a good idea to pick up these screws when you purchase the flange to check for a good fit.) After the wood has been mount-

This view shows a Cobra helicopter mounted upright. This facilitates access to the rotor head and control functions.

This is a full view of the completed stand. Note the small diameter of the base.



A Concept 30 is mounted vertically on the stand.



PHOTOS BY A. E. STANLEY

A helicopter is mounted in the inverted position.

ed to the flange, you can mount the vise to the top of the wood. Use the screws that are the same size as those you used to mount the flange. If you ever need to use the vise alone, you can remove it from the stand by taking out only three screws—a nice feature.

The only other thing you may want to do to your stand is add more weight to the base. I melted down some lead with a torch and molded it into the bottom of the base. I then screwed three small strips of aluminum to the base to keep the lead in place. If you don't have a torch or the lead, you can also weight the base by slipping a weight from an old weight set over the pole on the stand. You can even pick up a single weight at a sporting goods store.

The Panavise will expand up to nine inches to hold almost any machine. The base of this vise allows you to rotate the head 360 degrees and also tilt from the vertical to the horizontal. With features like this, you can put the machine in any position you choose.

Now that you've assembled a stand, adjust it to the height you like and clamp your machine in. Try a couple of positions to get a feel for how you like to set your machine up on the stand. I hope this stand works as well for you as it does for me and that it makes your maintenance easier the next time you have to rip your machine down. Happy flying! ■

NEW HELI PRODUCTS

TECH SPECIALTIES
Phoenix Conversion Kit

As the mythical bird rose from its ashes, so this Phoenix rose from the ashes of a legend—the GMP Legend. The TS Phoenix is a state-of-the-art, FAI-class competition, .60-size helicopter. It has a 9.3:1:5.2 gear ratio, a new FAI rotor blade and a new airfoil. Its main gear is machined of solid Delrin, and the main frames were designed for strength and ease of assembly. The servo tray, the lower radio floor, the main frames, the landing gear, the tail fins and the switch mount are made of aircraft-grade aluminum, and the servo tray and the lower floor include adjustable canopy mounts. The stock kit comes with black-anodized parts; the white powder coating (in photo) is an option.

Part no. TSHI

Price: $224.95

For more information, contact Tech Specialties, 218 Vernon Rd., Greenville, PA 16125; (412) 588-1335.

WEBRA
Speed .70 Heli Engine

Sometimes, the power of a standard .60-size engine isn't enough; that's why this engine was designed. The additional torque from the ABCD (aluminum piston/brass cylinder/chromed/dykes ring) makes the engine ideal, especially for scale-type helis, and it's extremely well balanced, so it delivers the vibration-free performance that's essential for flying helis. The Promix carburetor provides fast, reliable, mid-range response and top-end performance.

Part no. WE 1035 RCHABCD

Price: $409.99

For more information, contact Hobby Dynamics Distributors, P.O. Box 3726, Champaign, IL 61826; (217) 355-0022.

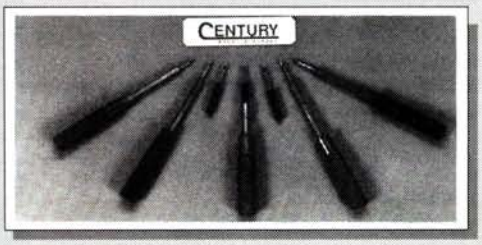
CENTURY IMPORT & EXPORT
Coast Guard and Navy Life Saver

This epoxy/fiberglass kit accepts all .60-size model engines. Its features include: a clear canopy with front windows; fiberglass side pontoons; scale struts; wheels; a scale retractable landing-gear system; a flexible tail-drive system; plywood, balsa and hardwood construction; an instruction manual; and full-size blueprints.

Part no. 4004

Price: $349.95

For more information, contact Century Import & Export, 521 Sinclair Frontage Rd., Milpitas, CA 95035; (408) 942-9525.



CENTURY IMPORT & EXPORT
Allen Driver and Universal Driver

These machined-aluminum drivers are guaranteed never to round off. Their handles are anodized in different colors to identify their sizes. The universal driver comes with 1.5mm, 2mm and 2.5mm tips, which also work with most power-drive units

For more information, contact Century Import & Export, 521 Sinclair Frontage Rd., Milpitas, CA 95035; (408) 942-9525.

FAI

(Continued from page 85)

Actually, a large model isn't strictly necessary; a smaller, lightly loaded model spanning around 65 inches and weighing no more than 7 pounds could really challenge the big ones for sheer performance. Part of the challenge is to know whether the judges would like the smaller maneuvers that are necessary to keep a correct relationship between straights and turns, apparent size of the model and size of the maneuvers.

The once-supreme Asano propellers have almost disappeared. In fact, copies abound, but American APC propellers and a few copies of the same (proof of success!) are everywhere. And Australian Bolly propellers and carbon tuned pipes are certainly better known now; these products count with the best and Somenzini uses them to good effect.

In summary, the 1991 World Championships in Autralia will long be remembered for the high level of competition, the increased American strength, the magnificent job performed by the Australians in organizing the event and the pleasant Australian atmosphere. The challenge is now on the Austrian organizers; I wish them as much success as the Australians enjoyed. ■

AIRWAVES

(Continued from page 8)

Yogi, we look forward to bringing full coverage to our readers. As for the Buffalo to Boston to New York leg at the end of May, we understand that the prevailing wind blows from the northwest, so, with luck, you won't be fighting any head winds. We can get detailed weather information to you as that date approaches. More important is the selection of the proper route. You'll need to avoid toll roads, of which there are several in this area, and your course will have to be scouted out well in advance and coordinated with local authorities.

Although we can't provide detailed answers

(Continued on page 94)

GOLDEN AGE OF R/C

HAL DeBOLT

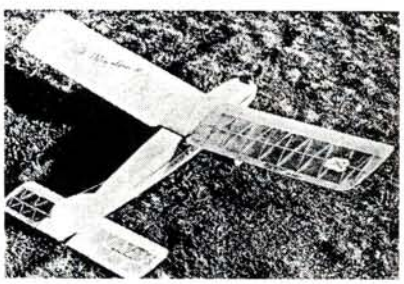
EARLY R/C DISTANCE RECORDS

TIME AND AGAIN, we've heard tell that a successful day of R/C flying in the early years was when you brought your bird home in one piece. A failure of some sort after a 5- or 10-minute flight or two was normal. Without fast-setting cement, repairing damage was an overnight job. For most modelers, the shortcomings of the equipment, the models and/or the pilot resulted in Russian roulette.

It has also been noted that many OTers were visionaries who dreamed of accomplishing feats that would be considered almost run-of-the-mill today. After a few successful flights with the marginal equipment, their dreams seemed possible.

The FAI finally recognized R/C as viable and, in the beginning, their record books were naturally empty. Never missing an opportunity, the Russians jumped in to set some world records using whatever they had. They established a distance record with an R/C flight of 8.6 miles. As I recall, the AMA noted the Russian action, and some of our modelers—Don Mathes, Ken Willard, Dick Everett and I—proceeded to replace the red star with the Stars and Stripes in the FAI records. Of course, these were the very early days; later, such people as Bill Northrup, Walt Good and, above all, Maynard Hill would set eyebrow-raising records. (Many of Maynard's records still stand.)

Of interest is the story of Dick Everett's effort to establish an early distance record. As you follow this saga, keep the lead-in of this column in mind and remember that, for a two-hour flight, Dick had to have perfectly reliable equipment; not just the R/C system, which ate dry cells as if they were peanuts and had many shortcomings, but also the engine and the aircraft structure, both of which weren't normally subjected to longevity.



El Monstruo—Dick Everett's, early R/C world-distance record model.

Hale Wallace of Rocky Mount, NC, provides us with an early Nats photo. That's Hale chatting with Ed Izzo under the "sunbrella." From their chairs, Dick Allen and Bill Williams guard their birds. Dick was campaigning the Aerocobra in Scale. I'm on the far right, contemplating a pretty pattern entry.

This story is an excellent example of the perseverance that was necessary to achieve a desired performance using early equipment. (You should also note how easy your modern equipment would have made it.) This story has waited until we had the space to tell it in its entirety. Dick went into great detail in his report, which seems unnecessary here. We hope that the highlights will do.

CROSS-COUNTRY

The time frame is the mid-'50s; the location, Southern California; the principal, Dick Everett—an accomplished R/Cer and a columnist for a major magazine of the day.

As Dick told it, the idea of setting a world R/C distance record had long been discussed in his modeling group. The subject would come up at the drop of a balsa splinter. For a long time, the obstacles seemed too great, but a discussion with Dr. Robert Chase brought out some positive ideas and the incentive to have a go at it.

Before an attempt to establish an FAI distance record, you must declare the takeoff and landing points and provide the exact longitude and latitude of each. A road map isn't sufficient! The best sources for such info are FAA navigational charts.

An optimistic goal of 100 miles (the existing record was only 8.6 miles!) was decided on, and the FAA charts were pored over to find an area where it would be possible to follow the model with a car for this distance. Fortunately, the deserts of California provided such an area; the takeoff point was pinpointed at Daggett airport and the landing point at Ludlow, some 37 miles down the road. Why only 37 miles? The 100-mile goal was truly optimistic, and Dick and his crew thought it would be best to get an official record under their belts before going for the ultimate. (Good thinking.) Also, the shorter hop would provide needed experience and data on fuel consumption and battery drain—giving an attempt at a longer distance added insurance.

With the objective and the flight envelope established, it was on to determining what was needed. Fortunately, there was some experience from which to draw. Ken Willard had recently established a world endurance record, and his experience provided clues about the necessary model size, power and fuel quantity. For example, it was anticipated that the flight's duration

(Continued on page 92)

NORTHERN VIRGINIA R/C CLUB

Early NVRC members gather at Bob Scott's home in 1966. From left to right—bottom row: Don Mulligan, Robert L. Scott, Art Seher, Bill Widner and Joe Tschirgi. Middle row: Tom Scott, Bob Scott, Jim Deckert, Betsy Clem, Pete Rawlings, Ray Eckenbach. Top row: Ron Clem, Bruce Stapleton, Bob Benton, Bob Crosby, Vince Neil, unknown, Dewey Soltow, Hal Peterson, unknown.

In the March '91 issue, we published a short bio on pioneer Dan Hensley and his modeling in this column. This brought input from some of Dan's old friends who were pleased to discover what he has been doing. One especially informative letter was from Ron Clem of San Diego, CA, who remembers Dan from Virginia in the '60s.

If you recall, Dan was one of the founders of the NVRC, which was inspired by the success of the DCRC across the Potomac in DC. Ron was kind enough to furnish some photos of early NVRC members. At the time, the membership of this young R/C club was small enough for everyone to fit easily into one photo; I'd hate to see them try that today!

The model in the photo is an interesting example of a '60s pattern design. Bob Scott was a nationally ranked pattern contestant, and this Candy design of his was a familiar sight at major meets, including the Nats.

"To fly is to crash" could have been an early R/C motto. Crashing was as certain as the morning sunrise! Obviously, the satisfaction gained between crashes overshadowed the gloomy side. Humor always helped, and the NVRC created some with their "Total (Totem?) Pole." All the members had the honor of attaching a piece from one of their demolitions to the pole. The photo shows Joe Tschirg making his contribution to the hilarity.

Ron gives us an illustration of Dan Hensley's character. Ron's first radio was a single-channel Citizen-Ship, which, for some reason, used a slide switch to control the Tx. At the field, Ron had difficulties trying to fly because of the slide switch. Apparently, Dan saw his problem and invited Ron to his him home where Dan replaced the slide switch with a normal push-button one. The result? Another beginner was saved for R/C posterity!

Ron tells us that, today—as a graybeard—he treasures those early NVRC activities; they formulated his lifelong R/C career. Advancing from single-channel to reeds to what was first called "multi-proportional" was exciting. In those days, there was something new and revolutionary every month. He concludes by saying that all we have today is "the radio," and seldom does it fail. We left the exciting moments back in the '60s!

The NVRC's "Total Pole." From left to right are Ron Clem, Joe Tschirgi and Bob Scott.

would be close to that made by Ken, who used a K&B .19 engine and 45 ounces of fuel. The K&B obviously had enough power, and the use of 55 ounces of fuel would provide a safety margin.

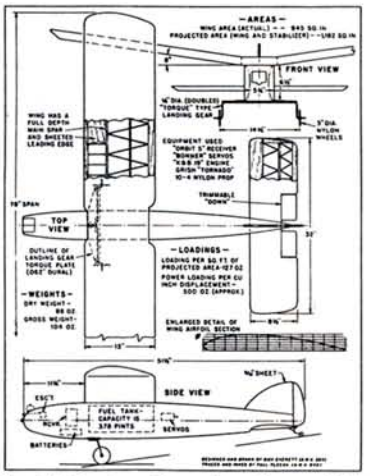
John Brodbeck of K&B was consulted about the engine's potential. His conclusions combined with a test program designed by Dick, determined that the K&B .19 would have sufficient power with a low enough fuel consumption to suit the task.

Orbit radio equipment was chosen for its reliability, and Bob Dunham gave it his personal attention. Info seems to indicate that the first model, which was unsuccessful, was flown with single-channel equipment because Dick mentions that he learned to fly multi with the second version. That would mean that Orbit reeds were used on the record flight.

Considerable thought was put into the plane's design. For instance, nearly 2 quarts of fuel represent considerable weight. For his endurance flight, Ken had used external tanks, but for simplicity and clean lines, Dick opted to design a fuselage around a sizeable, 55-ounce, custom-made, aluminum tank. For flight-trim purposes, the tank's CG was located slightly aft of the plane's CG. (Remember, the early systems had no trim capabilities.)

With Dick's arrangement and the initial aft CG, there would be an up-trim effect that would aid the takeoff and the initial slow climb to altitude. Then, as the fuel burned off, the CG would move forward, creating a desirable trim for cruising. (In those days, you had to design characteristics into a model to compensate for lack of trim features. Things are so much simpler today!) The big tank was positioned where the R/C gear would normally go, so the radio components had to be placed around it—the receiver and the batteries forward; the servos aft.

Dick felt that a low-wing concept offered the best takeoff characteristics, so that's what the first design was. The test flights showed that it was completely inadequate. The 680-square-inch, 10-percent-thick wing didn't develop the required lift. It was also obvious that, with



The El Monstruo three-view shows all the details that had to be added to this otherwise simple model for it to make the record flight.

a low wing, ailerons—instead of rudder—were needed for directional control. Aileron operation hadn't been developed at that point, so the first design was quickly scrapped.

With lessons learned from the first model, a shoulder-wing design of 1,000 square inches with ample dihedral was laid out. Although the design of the plane was simple, it's landing gear was a noteworthy feature. A .062-inch-thick dural plate provided the required track width. Because thin, plastic, nylon wheels were used, the music-wire gear was attached to the plate in torsion fashion to provide the necessary shock absorption.

Test flights with the second design brought out two factors. The plane proved to be a docile, excellent flier without any bad traits but, with its robust structure and a .19 for power, there was no way the plane could carry a full fuel load. Also, the pressurized fuel system proved unreliable. Such details!

A solution was found by building a third model. This time, the use of a free-flight style structure solved the weight problem, but the fuel feed was still a stickler. At the time, Jim Nightingale was a nationally renowned C/L speed flier and engine expert. He suggested using a check valve in the fuel pressure line. The rear cover of a Cox reed-valve engine was used to make a neat check valve and, for a cost of 75¢, the final hurdle was out of the way.

Even with a model that had the potential to do the job, establishing the record was exasperating. We've said that an official short-range flight would be made for test purposes and, in the end, that proved to be all that circumstances would allow.

It takes advance preparation, notification and much paperwork to set up an FAI record attempt. All this was handled admirably by the AMA's Carl Wheeley.

The first takeoff was made from Daggett Airport, and the flight lasted just two minutes, owing to a blown glow plug. Actually, it was a godsend because, shortly after landing, a strong wind blew in that would have been disaster for the model. A few more attempts were scheduled but, each time, the weather was a problem. All this in normally sunny California!

Finally, on April 12, Dick and his support crew were up well before dawn for their preparations. The only change from the original plan was the use of a 16-ounce regular-style R/C tank in place of the big one needed for the long flight. In the early morning light, all systems checked positive, and the word was "go." The takeoff was routine, and with cooperating weather, the flight to Ludlow was relatively uneventful. They set a new record (almost five times longer than that set by the Russians), and they had the assurance that the contemplated 100-mile flight was feasible.

Dick went about planning for the optimistic 100-mile flight. Data indicated that they had overestimated fuel consumption and that the 55-ounce tank would be enough for 150 miles. As a result, they picked a spot 130 miles down the road as their objective.

The first attempt was thwarted by the "sunny" California weather. The second try found them at the field fully prepared to fly, but before they could get airborne (lucky again?), the wind shifted 160 degrees, and they were foiled again.

What followed this is a mystery, but it's easy to see how all the unfulfilled preparation could be humiliating. Perhaps Dick just succumbed to the weather gods, and said a record is a record; we have one, so let's just go flying!

AIRWAVES

(Continued from page 90)

to many of your questions in this space, we think that, with the help of interested U.S. modelers, there's a good chance they can be answered in time to make the trip a success (there is, of course, a precedent—Bob and Doris Rich's R/C flight from Kitty Hawk, NC, to Oceanside, CA, in late '75).

If Yogi succeeds in the first portions of his flight, he'll be arriving in the U.S. only a few weeks after publication of this issue. If you or your club wish to assist Yogi, you can send a letter to "Trans World Flight," c/o Model Airplane News, 251 Danbury Rd., Wilton, CT 06897. These will be forwarded to the U.S. coordinating team, which is being assembled at the time of this writing. A direct contact at Yogi's home base is "Jim" B.G. Natsure, who can be reached in India at this phone number: 011-91-212-334757; or at Fax number: 011-91-212-792574 or 665677; or at the address noted. TA

BABY BIPES!

I'm 13 years old, and I've been modeling for about six months now. My first model was a Sig glider called the "Riser." After a while, I realized that gliding just wasn't for me, so I bought a trainer—the PT 20—powered by an O.S. Max .25. Now I'm looking for a 4-channel, easy-to-build, easy-to-fly biplane that can

(Continued on page 106)

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do some aerobatics and is powered by an O.S. Max .25. Thanks for reading! I'll be waiting.

MICHAEL RICHTER
Santa Barbara, CA

Mike, having graduated from the glider to a .25-size high wing qualifies you as an advanced beginner. The .25-size engine is really popular, and there are many intermediate sport designs to chose from. As .25-size biplanes go, there aren't too many that are easy to build and fly. There's also more work involved because you have another set of wings to hang on your model, and you must ensure they're set at the right incidence. In general, bipes usually have shorter spans and tail moments to make them more aerobatic; thus, they're more demanding to fly.

I suggest that you first go to a higher performance shoulder-wing design before you tackle a bipe. The .25-size kits we did find are the Tidewater Parakeet (the easiest to build and fly), the Royal Pitts S-2A mini kit (more difficult to build and fly), the Gee Bee Tiger Moth (intermediate difficulty) and the Flyline Great Lakes Trainer (also somewhat difficult). It's up to you, though, if you want to undertake the challenge of becoming a "Biplane Barnstormer." Whatever you do, seek the help and advice of an experienced modeler. Good luck! Addresses: Tidewater Hobby Enterprises, Inc., 3925-C SE 45 Court, Ocala, FL 32671; Royal Products Corp., 790 W. Tennessee Ave., Denver, CO 80223; Flyline Models, 10643 Ashby Place, Fairfax, VA 22030 and Gee Bee Products, P.O. Box 18, East Longmeadow, MA 01028. GY

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LEGEND

SPECIFICATIONS

Type: high-performance sailplane
Name: Legend
Manufacturer: Airtronics
Wingspan: 113 inches
Weight: 75 to 80 ounces
Wing area: 997 square inches
Wing loading: 10.8 to 11.6 ounces per square foot
Length: 49 inches
No. of channels req'd: 4 (rudder, aileron, elevator and flaps)
Radio used: Airtronics Vision 8SP
Airfoil type: Selig 3021
Wing construction: Built-up
Kit construction: Fiberglass fuselage, built-up balsa rudder, stabilizer and elevator
Price: $299

Features: the kit includes an epoxy/glass fuselage that's reinforced with Kevlar; contest-grade balsa sheeting; band-sawed and sanded ribs; aircraft-grade plywood formers and spruce strips; a carbon-fiber pushrod and lever drive for the elevator; a Dacron cord for pull/pull rudder control; a complete hardware package; plans and a 43-page, photo-illustrated instruction manual.

The kit is carefully packaged with bagged components stapled to the inside of the box.

Hits

- The Legend delivers competition-level flight performance.
- The instructions, materials and parts fit are good, and the glass work on the fuselage is of high quality.
- The Legend is suitable for intermediate-level builders.

Misses

- The advertised weight range of 70 to 75 ounces is unrealistic. With weight-saving changes, mine came to 80 ounces.

The full-size, computer-drawn plans contain a lot of detailed information. The instruction manual is precise; it's like having the designer in your workshop telling you how to build the model! There are 43 pages with 37 photos. The introduction reads as follows: "The Legend has been designed and produced to give the discriminating radio-control soaring pilot the ultimate competition sailplane. The Legend uses a combination of the latest advances of aerodynamic and structural technology, conventional building methods and traditional Airtronics quality to meet its goal of being the finest sailplane kit on the market."

Specialized tools or jigs aren't required to build the Legend; just the basic tools you'd normally find in a hobbyist's workshop.

TAIL-POST ASSEMBLY

The tail-post assembly consists of the tail post, the elevator pushrod, the elevator actuator and the rudder hinges. It's easier if you assemble these components outside the fuselage and then install them as a complete unit.

FUSELAGE ASSEMBLY

Slow-curing epoxy is recommended to bond all wooden parts to the fuselage. Use coarse sandpaper, and roughen the areas shown on the plans and in the manual where you epoxy the plywood formers, wing hold-down, servo rails and tail-post assembly. Clean the sanded areas with acetone before you epoxy!

TAIL FEATHERS

The rudder, the stabilizer and the elevator are basically all built in the same manner, i.e., they're framed directly over the plans (use wax paper to protect the plans). Use a slow CA, and sand to shape.

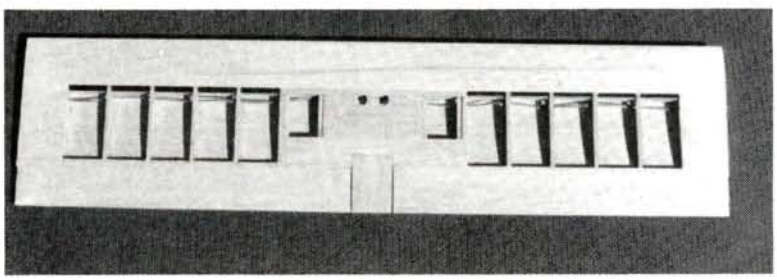
WING ASSEMBLY

The wing is made up of three sections: the center section (which withstands the stress of hard zoom launches and hard landings) and the two outer panels. Pay particular attention to the assembly of the brass joiner tubes that align the two outer panels and also to the bonding of the .007 carbon-fiber reinforcement on the top and bottom of the spars.

The center panel is built in several segments. First, cut the sheeting to the required size, and pin the lower sheeting to the center panel plans with wax paper between the two. Mark the rib position on the sheeting as indicated on the plans, and glue the $^1/_4$x$^1/_{16}$-inch capstrips in place.

Join the main spar assembly to the lower sheeting with thick CA. I used UFO* for this. Next, glue the rear W-1D ribs to the rear of the main spar with thin CA. (I used Hot Stuff*.) Glue the wing trailing edge and flap leading edge to the sheeting with thin CA. (They're butted together, but be sure that they aren't glued to each other—just to the lower sheeting. Cut them free after the wing has been completed.)

Cut the triangular flap and aileron ribs out of $^1/_8$x$^5/_{16}$-inch balsa stock (as shown on the plans), and glue them into place with thin CA. Sand to shape following the side-view profile shown on the plans. Install the flap-servo hatch rails exactly as shown on the plans. Once this has been completed, sand all high points, install the servo

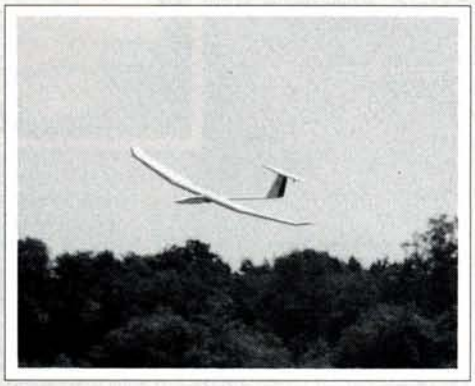


The bottom view of the center panel shows the aileron extension cables and servo-opening hatches.

FLIGHT PERFORMANCE

I set up all my control throws as outlined on the plans. After a few good hand launches and a little elevator adjustment, I was ready for the winch launch.

- **Takeoff and landing**
  Winch-launch takeoffs are steep with no tendency toward "squirreling." Tow-line release was high and smooth. The first launch was performed without flaps, and the winch pulled at a moderate level, which resulted in a good launch and a 5-minute flight. Once I had gained confidence with the first flight, I used the flaps for the second flight, and put the pedal to the metal. I zoom-launched, and my efforts produced a 12-minute flight. When the transmitter is programmed according to the instruction manual, landing approaches in the crow mode and 90-degree flaps result in a steep decent without gaining speed. This makes smooth, precise contest spot-landings possible.



- **High-speed performance**
  When the Legend is placed in a steep dive to build up speed, it exhibits no tendency to flutter and is unusually quiet in a fast flyby. It's obviously an aerodynamically clean design. Control is very precise. The only trim change required is during launch and landing: up-elevator during launch and down-elevator during landing, both of which should be programmed into the radio, as described in the manual.

- **Low-speed performance**
  The Legend has excellent slow-speed flying characteristics, and this makes it ideal for thermalling at very low altitude and in light lift. The predictable Legend will let you know when it's about to stall: the wings "buffet" slightly. At that point, all that's needed is slight down-elevator to pick up speed. Thermal turns can be very flat and tight. The turn radius is much tighter than a rudder/elevator-controlled polyhedral sailplane, because it's an aileron ship. Yet, with it's winglets, it has the stability of a polyhedral ship.

- **Aerobatics**
  Although not specifically designed for aerobatics, the Legend is a high-performance thermal sailplane. At high altitude, it performs respectable axial rolls, provided speed is maintained. This requires high rate on the ailerons and a slight dive before entering the maneuver. I like to do this after coming out of a nice loop. Inverted flights are easy: go into a half roll and hold full down-elevator to maintain level inverted flight.

  Construction of the wing panels, especially the main center section, is extremely rugged, and they'll withstand the high Gs imposed by winch launching. The Kevlar-reinforced fuselage should also withstand many hard contest landings without suffering fatigue. A few words of caution: when you perform aerobatic maneuvers with this plane, make sure there's enough strong tape to hold the outer panels to the main wing section.

  I found out about the tape the hard way when I attempted high-speed aerobatics with only a small strip of tape on the leading edge and on the underside of the panel joint. I was flying in a killer thermal, and the Legend was virtually out of sight. I decided to do some aerobatics to lose some altitude. While performing axial rolls trying to get out of the strong lift, to my shock, my right wing panel blew off in flight and the Legend started to spin violently toward the ground. I immediately applied full flaps, which stopped the spin and caused a slow tail-over-nose tumble. I then applied full left aileron and rudder away from the lost wing panel and pulled the flaps back up. To my amazement, I was able to regain control of the Legend. I brought it into a shallow turn gently to the left, opposite the lost wing panel, and it landed ever so gently in some high grass without so much as a nick! It's hard to believe, since the outer panel is more than half of the right wing. Since then, I've been using a single strip of 1-inch electrical tape applied all the way around each panel joint, and I've had no more problems.

extension wires and temporarily tape them into position. Bond the upper sheeting according to the instructions. This procedure is fairly simple. Once the sheeting is in place and the sanding has been completed, use a straightedge to cut the flaps free from the center section.

With the exception of the wing-tip blocks, the outer panels are built in a similar manner, and they're easily shaped and sanded.

The plans show the aileron hinge on the bottom and the gap beveled at the top. (This is supposed to prevent the control horns from being damaged by landings in high grass.) Since the aileron deflection is much less in the down position, I decided to hinge my ailerons at the top, and this required a much smaller gap at the bottom of the aileron.

WING AND STAB ALIGNMENT

Carefully drill the hole for the 1/4-inch wing hold-down dowel in the center wing panel as shown on the plans, and align the wing with the 1/4-inch plywood leading-edge former in the fuselage. Some filing may be needed for a good fit. After the alignment has been completed, square the wing to the fuselage, and drill and tap the wing hold-down bolt using a 1/4-20 tap.

Mount the stabilizer on the fin, and align it to the wing center panel. When the alignment has been completed, also drill and tap the stabilizer to the fin using the 1/4-20 tap. Cut the outer wing-panel alignment dowels, and align them to the center panel using the plans as your guide. Glue the winglets to the outer wing panels using thick CA, and raise them 1 5/8 inches above the building board. Cut the ailerons and flaps free from the wing panels, and bevel the leading

edge to the proper angle, as shown on the plans.

SERVO HATCHES

The four wing servos are mounted on 1/16-inch plywood, which is then mounted to the wing using four no. 21 3/8-inch sheet-metal screws. I use Airtronics 94141 servos that have all-metal gears and can be mounted upright or on their sides to make servo wing mounting easy.

FINAL ASSEMBLY

Install the front and rear canopy hold-downs, and fit the canopy to the fuselage with the center wing panel mounted. Make sure the canopy gear clears the top of the wing leading-edge sheeting. Sand the fuselage with 320-grit sandpaper, and fill the pinholes with automotive glazing putty. I sprayed on two coats of white primer, (sand between coats) and two coats of white paint.

COVERING

To protect the wood under the covering, I brushed on a coat of thin Balsarite* onto all the balsa and vacuumed it clean. I used the new UltraCote covering from Goldberg Models*, and it went on easily and stayed taut after heating. (The Legend instructions include a helpful section on covering the model!)

RADIO INSTALLATION

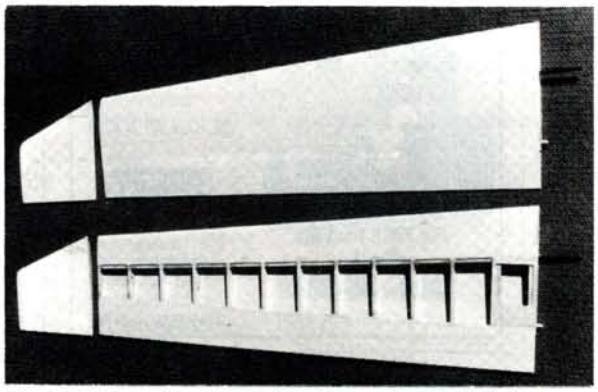
Install all the control horns, and hinge the flying surface with the clear tape provided in the kit (by the way, it's an excellent tape).

The radio I chose was the Vision* 8SP. It's very easy to program and extremely reliable. I've used it in temperatures that have ranged from less than 20 degrees F to over 90 degrees F without problems.

I mounted the servos, the receiver, the battery pack and the tow hook exactly as shown on the plans. Instead of mounting the horns and mounting screw on the rudder, I wrapped the Dacron pull-pull cord once around the rudder post and through a hole drilled where the two rudder horns would have been placed. I secured the Dacron cord by gluing (CA) a toothpick plug into that hole. By doing this, I was able to keep the Dacron cord entirely inside the fuselage. This eliminates the weight of the horns and screw from the rear of the fuselage and makes it a touch more aerodynamic. At the servo ends, I used Sullivan* 2-56 steel eyelets to tie the Dacron cord; then I screwed Sullivan metal clevises onto the servo arms and adjusted the tension on the cords until the rudder pivoted smoothly. I also eliminated the tail skid to keep the weight down at the tail section.

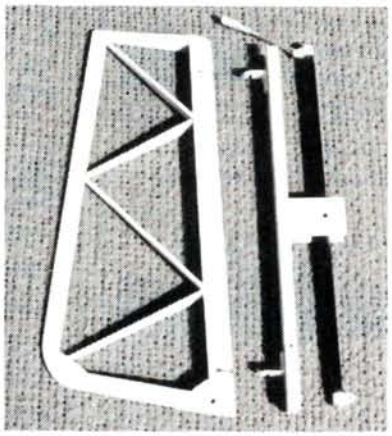
Don't forget to balance the wings laterally before you balance the model to the CG. I needed approximately 8 ounces of lead shot to balance my Legend to the CG as indicated. The total flying weight came out just under 80 ounces.

The Legend logo that's shown on my finished model isn't included in the kit. I had the folks at Vinylwrite* make up mine and, as usual, they did a great job.



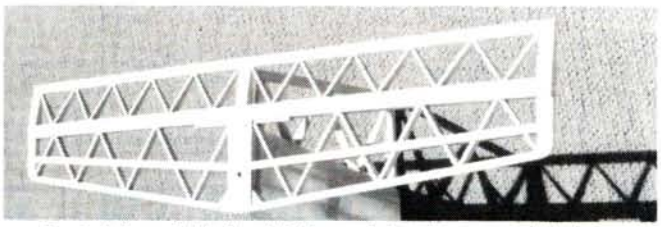
PHOTOS BY SAL IASILLI

Top and bottom view of the outer wing panels and winglets.



The tail post and rudder are shown. The elevator linkage can be seen.

"The full-size, computer-drawn plans contain a lot of detailed information. The instruction manual is precise; it's like having the designer in your workshop...."



To minimize weight, the stabilizer and elevator are completely built-up.

FLYING

I set up all my control throws as outlined on the plans and used them as my starting point (these were: aileron—3/8 inch up, 1/4 inch down; rudder—1 1/4 inch right/left; elevator—3/8 inch up and down; launch—flaps 5/8 inch down; and landing—flaps 90 degrees down, elevator—1/4 inch down, ailerons—1/4 inch up, crow.) After a few good hand-launches and a little elevator adjustment, I was ready for the winch launch. The first launch was performed without using flaps and using not too much winch; it still resulted in a good launch and a 5-minute flight.

Three weeks after completing the Legend, I took second place with it at a regional Eastern Soaring League competition in the Sportsman Class. I've been flying the Legend now for more than a month in just about every type of flying condition from downwind launches to high winds to no wind at all. I haven't found any bad habits, and its stability instills confidence. The Legend is a pleasure to fly.

**Here are the addresses of the companies mentioned in this article:*
***Airtronics Inc.,** 11 Autry, Irvine, CA 92718.*
***UFO;** distributed by Satellite City, P.O. Box 836, Simi, CA 93062.*
***Hot Stuff;** distributed by Satellite City.*
***Balsarite;** distributed by Coverite, 420 Babylon Rd., Horsham, PA 19044.*
***Carl Goldberg Models,** 4734 West Chicago Ave., Chicago, IL 60651.*
***Vision;** distributed by Airtronics.*
***Sullivan Products,** P.O. Box 5166, Baltimore, MD 21224.*
***Vinylwrite Custom Models,** 16043 Tulsa St., Granada Hills, CA 9134*

AIRWAVES

(Continued from page 106)

ELECTRIFIED

Less than one year ago, I became interested in R/C, mainly because I finally discovered through your magazine that electric flight was a reality. Being a mechanical engineer, I then decided to build an electric R/C plane. As I had no ready access to kits or even plans, I decided to scratch-build. The overall proportions were taken from illustrations in several *Model Airplane News* issues.

It took me a while to get used to the jargon and the acronyms of the hobby (e.g., to discover that the Carl Goldberg Turbo 550 motor I had was a class 05 motor, I needed three issues). Owing to lack of space and maybe to add a little more to the challenge, I decided that the wing would be made of foam.

Before deciding on the radio, the first prototype was a free-flight, stick type, with a wingspan of 54 inches that flew for 15 seconds and stalled at 30 feet after two complete circles. The stall was probably caused by the wing's 20-degree angle of attack.

After proving to myself and to some innocent bystanders that an electric plane was, in fact, possible, I selected the Futaba 4NBLE radio with two S133 servos and throttle to provide some means of guidance to my second prototype.

In a visit to a local R/C club, I was politely advised to increase the wingspan of my prototype. As I had already made two white-foam wings reinforced with a balsa spar, soon after, I had one nice, big wing with a wingspan of around 54 inches and a dihedral of about 15 degrees. The tail surfaces came from the full-size plans of the Bee-tween (July '91, *Model Airplane News*). This model was flown successfully by my instructor for about 10 minutes with the help of some thermals.

I have now made a 66x9-inch blue-foam wing with a flat-bottom airfoil—uncovered, but reinforced with a carbon-fiber strip on the bottom. Even though it flies, I'm not happy with the results and would like to exchange ideas with some of the electric-flight specialists on your staff. Some of my questions are:

1. What's the ideal wing loading for an electric sailplane using the CG Turbo 550 and six cells? What airfoil?
2. What's the best prop—an 8x4, 8x5, 7x4, or 7x6?
3. What's the best glue to use with foam? I've used thin CA to glue foam to balsa and carbon fiber, but the results aren't consistent.
4. Am I the only one using uncovered foam wings? The wet fliers at the club give me that kind of look when they see my wings, and I

(Continued on page 116)

AIRWAVES

(Continued from page 115)

laugh when they're cleaning their models.

5. How are ailerons installed on a foam-only wing? Do I need them?

Congratulations for the finest R/C magazine!

JORGE LUIZ FARACO
Sao Paulo, Brazil

Jorge, I got together with David Baron, a Model Airplane News contributor and designer of some extraordinary, high-performance electrics, to provide some answers.

1. If you can achieve a wing loading of 10 ounces per square foot with an electric sailplane design, pat yourself on the back. I know of at least one German-designed, electric sport twin kit with a wing loading above 30 ounces per square foot so, depending on the type of plane you fly, there's room for experimentation! Remember, also, that you must have a balanced design; if the design is too "short coupled" i.e., the nose and tail moments are too short, getting the CG right will be more difficult. When you lengthen the wingspan, you should also lengthen the entire fuselage. Similarly, you should increase the rudder and fin area by a percentage that parallels the increase in wing area.

We recommend that you go to seven cells for greater climb-out performance. We feel the best power-to-weight ratio is provided by the Sanyo 900mAh SCR cells or equivalents. Although capacity is reduced, their advantages include a low internal resistance (high discharge rate) and minimal weight. There are many airfoils to choose from. What you need is descriptive data so that you can pick the airfoil with the attributes you favor. An excellent source is "Airfoils at Low Speeds" (Soartech 8), by Selig, Donovan and Fraser, 1989. It's published by H.A. Stokely, 1504 N. Horseshoe Cir., Virginia Beach, VA 23451. Also, see Andy Lennon's two-part series on understanding airfoil plots, Part 1 of which is in this issue.

2. With a direct-drive sailplane and motor (as mentioned), we recommend that you keep the pitch to 4 inches. Why not try a geared drive?

Then you can go to an 11x7 or a 12x8 prop, and the plane will really grab the air as it climbs out. Of course, direct-drive planes designed for speed can use props in the neighborhood of 8x5 or 7x6, or higher pitch. The requirement is to match the prop to the application, and experimentation should verify the best match.

3. CA tends to attack foam, and that's the cause of your mixed results. One way around this is to use one of the new, odorless CA glues, such as Pacer's Zap-O or Satellite City's UFO CA. If you want to simplify life, you can also use one of the white glues, or aliphatic resin wood glues. Sig also offers Core-Bond, a specially formulated adhesive for permanently bonding balsa, plywood, plastic, or cardboard wing skins to foam-core wings, without attacking the foam. If you can't locate these products at your local hobby dealer, Zap products are distributed on the U.S. East Coast by Frank Tiano Enterprises, 15300 Estancia Ln., West Palm Beach, FL 33414; (407) 795-6600. Satellite City's address is: P.O. Box 836, Simi Valley, CA 93062; (805) 522-0062. Sig's address is: Sig Mfg. Co. Inc., 401 S. Front St., Montezuma, IA 50171; (515) 623-5154.

4. You aren't the only person using uncovered foam wings! Although many eschew raw foam

(Continued on page 119)

CLASSIFIED

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BERKELEY, CLEVELAND, ETC., replica kits, duration rockets for jet models. Send three stamps to: WILLAIRCO, 2711 Piedmont Rd. NE, Atlanta, GA 30305.

WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

1930s to 1950s MODEL AIRPLANE MAGAZINES; 1930s aviation pulps, complete and good condition; $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

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WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; (918) 245-3649.

WANTED: Berkeley and Cleveland kits or related items: parts, plans, boxes, brochures, books, ads, radio equipment, accessories, etc. Gordon Blume, 4649-191st Ave. S.E., Issaquah, WA 98027.

ANTIQUE IGNITION AND GLOW PARTS CATALOGUE: 100 pgs., timers, needle valves, original cylinder heads, point sets, drive washers, stacks, spark plugs, plans. Engines: Atwoods, Baby Cyclones, McCoys, Hornets, others. $8 postpaid U.S., Foreign $20. Chris Rossbach, R.D. 1 Queensboro Manor, Box 390, Gloversville, NY 12078.

INTERNATIONAL AIRCRAFT RESEARCH—Need documentation? Include name of aircraft for availability of documentation with $3 for 3-view and photo catalogue. 1447 Helm Crt., Mississauga, Ontario, Canada L5J 3G3.

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ENGINES: IGNITION, GLOW, DIESEL—new, used, collectors, runners. Sell, trade, buy. Send $2 for large list to Rob Eierman, 504 Las Posas, Ridgecrest, CA 93555. (619) 375-5537.

PLANS ENLARGED—dot-matrix plotting software; scanning/plotting CAD. Free information. Concept, P.O. Box 669E, Poway, CA 92074-0669; (619) 486-2464.

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R/C HOBBY SHOP/GAME ROOM—health forces sale. Asking $73,000, which is in inventory and fixtures. Jasper, TN (615) 942-4035/942-3703.

GIANT-SCALE PLANS—send SAE to Dry Ridge Models, 59 McCurry Rd., Weaverville, NC 28787.

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WHAT A BARGAIN!—found in heated warehouse: 84 brand-new, all-balsa "Cutlass Supreme Mk II" deluxe kits designed by Don Coleman and produced by Mini-Flite Co. of NJ in 1973. (Oops, my mistake! In previous issues, plans were attributed to Don Lowe.) The 64-inch tapered-span kits are complete with die-cut balsa, spruce spars, full hardware packages, etc., and full-size plans with details for optional retracts. The balsa alone is worth the price! *Once in a lifetime buy* at $59 each plus $15 shipping. First-come basis. *Special for clubs or groups:* four kits shipped in one carton for $215 ppd. in the U.S. Money order or bank check or, to order picture and specs, an SAE to: Fred Angel, 33 Boston Tpk., Shrewsbury, MA 01545; (508) 754-4197.

WANTED: Morton M-5 radial for cash. Pre-war Korn, Dooling, etc., racers. Fine machinist's models. Top cash. J. Kramer, P.O. Box 8102, Pittsburgh, PA 15217; (412) 621-3977.

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MODEL MAGAZINES (1930 to present): *Air Trails, American Aircraft Modeler, Flying Aces, Flying Models, MAN, RCM* and others. Complete sets and spares available. David L. Brown, 61 Coach Rd., Glastonbury, CT 06033-3237; (203) 659-2412.

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AIRWAVES

(Continued from page 117)

wings because of their cosmetic appearance, the rough surface of the exposed foam creates microscopic turbulence that actually increases the performance of model-size airfoils. Turbulators and other devices that "rough up" the top surface of the airfoil near the leading edge are often used by experienced modelers whose planes have glass-smooth wings. Of course, top performance sailplanes have glass-smooth surfaces except for the possible use of turbulators, so you'll be paying some drag penalty with exposed foam. Also note that if you install ailerons, a covered wing will make it easier to seal the gap between aileron and wing, e.g., by using film hinges.

5. If the most powerful motor at your disposal is the 550 on six or seven cells, you face the question of whether the drag caused by the addition of ailerons will cause you to lose more than you gain (a subjective, but serious, question for the electric model designer!). Drag is the enemy; defeat drag, and efficiency will skyrocket. In any case, to install ailerons, cut out the ailerons by carving a 1/4-inch-wide slot right down the middle of the aileron hinge joint. Cap both the wing trailing edge and the aileron leading edge with 1/8-inch-thick sheet balsa. You can simplify life by building the wing trailing edge at a 90-degree angle to the chora line, and the aileron leading edge can slope back from its upper surface to allow for downward deflection.

One of David's electric designs may give you some ideas. It's a modified Astro Flight Mini-Challenger. The stock plane has a 60-inch wingspan, length of 30 inches and a wing area of 400 squares. In its kit form, it runs on six 900mAh Sanyo cells that power a Cobalt 035 motor.

David installed an Astro FAI 05 Cobalt running on seven 900mAh SCR cells and spinning an 8x5 prop. To reduce drag, the tail was made into a swept T-tail (15-degree stab sweep, 30-degree rudder sweep). The rudder and elevator areas remained as per the kit. The fuselage was

(Continued on page 122)

AIRWAVES

(Continued from page 119)

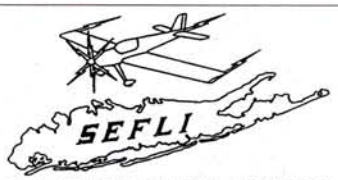
rebuilt with more rounded contours. Its aft end was lengthened by 4 inches (partly to accommodate the sweep of the tail feathers), and the nose was lengthened by 2 inches. The wing remained in the same configuration but, near the front of the airfoil, it was strengthened with reinforcing spars that serve as turbulators by creating slight ridges on the upper wing surface. This plane is capable of four to five climb-outs to about 500 feet and shows a spectacular speed range (including the ability to accelerate into a head wind that would literally keep most electric sailplanes in a hover at best). Let us know how your designs progress. TA

P-40 FAN

The February 1992 issue of *Model Airplane News* has an excellent three-view of a P-40F in the "Fifty Years Ago" section. Where might I find a three-view of this quality of the early model P-40, such as the "C" or "B" that the Flying Tigers flew? I'm building a 1/5-scale version of one of these, but I'm still lacking a good

(Continued on page 127)

CLUB OF THE MONTH



SILENT ELECTRIC FLYERS OF LONG ISLAND (SEFLI)
c/o Don Mott, Box 461, Ridge, NY 11961

SEFLI is a progressive, electric-flight aeromodeling club with its eye on technical innovation. This club's approach combines good-natured fun with serious inquiry into silent-flight technology.

The January newsletter shows the technical orientation of the club. The editor invited readers to send in reviews and commentary on modeling software (e.g., airfoil, design, electric motor analysis, etc.). A review of '91 flying-field highlights included the pursuit of vee-tail configurations, staying airborne at low altitude for 20 minutes on electric power, electric float flying, U-control electric flight and more. George M. Myers, "Model Aviation" columnist, offered Part 2 of "One Man's View of How AMA History Was Driven by Technology"—an intriguing piece as philosophic as it was brief. John Jabour provided a detailed review of the Whisper electric heli.

The club's philosophy implicitly acknowledges the need to save flying fields, and the club has had some success in promoting its aeromodeling activities to a county legislator and to the park authorities. A senior park supervisor, in response to an offer from SEFLI to "adopt" a part of the local county park, stated thanks for SEFLI's help in the coordination of flying field activities. Because of their "model" activities in promoting aeromodeling, we award two one-year *Model Airplane News* subscriptions to SEFLI.

HOBBY SHOP DIRECTORY

Retailers: Make your business grow with new traffic! Now you can advertise your hobby shop in the ***Model Airplane News*** **Hobby Shop Directory**. The listing will be published monthly and will be listed according to city and state. You will have 3 to 4 lines, approximately 20 words, in which to deliver your sales message, plus space for your store's name, address and telephone number.

HOBBY SHOPS: Act now and get the first ad free! Directory space is sold on a yearly basis with a choice of three payment plans: 1. $179 per year, payable in advance; 2. $97 for six months, payable in advance; or 3. $17.50 per month to be billed monthly. Space reservations must be received by the 10th of the third month preceding publication (for example, January 10th for the April issue).

CALIFORNIA—Torrance/Gardenia
Your one-stop R/C shop. We try to carry it all. Major items discounted. Help and advice free. Building and bull sessions allowed on premises. Near LAX.
Owner: John Eaton.
MODEL CENTER
2304 Redondo Beach Blvd. **(213) 327-3862**

FLORIDA—Winter Springs
- UPS orders shipped daily
- Dealer for Yellow Aircraft
- Send $3 for Yellow info pack
- Full line of hobby accessories
- Visit our showroom (35 min. from Disney World)

BOB FIORENZE HOBBY CENTER, INC.
420 W. S.R. 434 **(407) 327-6353**

ILLINOIS—Chicago
Chicago's largest hobby shop. R/C planes, helicopters, boats and cars. R/C repairs, installations and custom building. Mon.-Fri. 10-9; Sat. 10-6; Sun. 11-4.
STANTON HOBBY SHOP, INC.
4734 Milwaukee Ave. **(312) 283-6446**

LATIN AMERICA
COSTA RICA—San Jose
Complete line of R/C airplanes, cars, boats, and helicopters. Parts and professional expert service and advice. Julio Pastura, President. Weekdays 4-10 p.m.
EL HOBBY SHOP
Centro Commercial, San Jose 2000
Apartado 529, Centro Colon **32-26-81**

NEW JERSEY—New Brunswick
R/C helicopters: Concept, Schluter, Parts & Accessories
R/C cars, coats, parts & accessories
Customer Support Available
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HOVER CENTER PLUS, INC.
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NEW YORK—Brooklyn
R/C planes, helicopters, boats and cars.
Huge discounts on all R/C equipment.
Futaba radios at incredible savings!
Special discount for club members!
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HOBBY KING
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R/C planes, helicopters, boats, cars, rockets and jets
Full line of parts and accessories
Huge inventory! If we don't sell it, they don't make it!
Bob Violett dealers
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Discount prices everyday!
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THE ULTIMATE HOBBY
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(Off Ave. "U" & E. 70th)

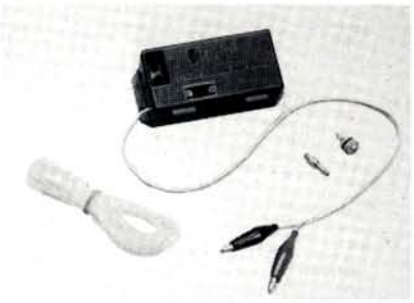
NEW YORK—PENFIELD
Full-service hobby shop
27 years of R/C experience!
Airplanes, boats, rockets, pine cars, plastic and wooden models, tools, accessories.
Daily UPS shipping worldwide—special orders encouraged!
Dealer for Ace, Hitec, JR—sales and service.
PANCO HOBBIES
1865 Penfield Rd. (Rt. 441) **(716) 383-1320**

OHIO—Findlay
Findlay's local R/C dealer, planes—cars—boats. We specialize in R/C, large selection of kits, accessories and parts. We're authorized Sig and Dremel dealers. We also sell model rockets.
Tue. & Thu. 1-9;
Mon., Wed., Fri., & Sat. 10-9.
JINX MODEL SUPPLIES
721 Rockwell Ave. **(419) 422-5589**

OKLAHOMA—Tulsa
R/C Specialists, planes, helicopters, cars and boats. We also have kites, boomerangs and plastics. Experienced personnel to answer all your questions. AE, Visa, MC.
Hours: Mon.-Sat. 9-7, Thurs.,Till 8.
WINGS 'N THINGS HOBBY SUPPLY, INC.
5241 S. Peoria Ave. **(918) 745-0034**

Send sales message and payment to ***Model Airplane News*** **Hobby Shop Directory,**
251 Danbury Rd., Wilton, CT 06897. **For more details or information on our special introductory offer, call toll-free (800) 243-6685 and ask for Laura Kidder.**

PRODUCT NEWS

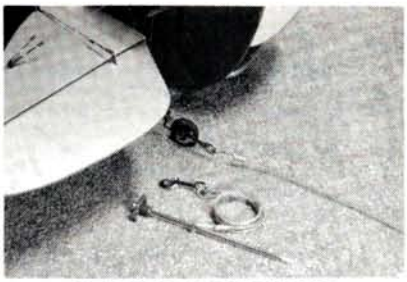


ROYAL PRODUCTS
12V Fuel Pump

For model or diesel fuel, this new pump moves fuel quickly and without leaking. Use it to fill or drain your tank, attaching it to your battery by means of the handy alligator clips. It comes with a fuel nozzle, a filtered fuel-can clunker and tubing. With its built-in hooks, it can be attached to the fuel can easily, and a built-in mounting plate allows you to mount it on your field box or fuel station.

Price: $22.95

For more information, contact Royal Products, 790 West Tennessee Ave., Denver, CO 80223-2875; (303) 778-7711.



STRAND PRODUCTS
Giant Tether Cable

Now you can adjust your equipment, or walk around your big bird confidently while you do running-engine checks. This self-coiling, 36-inch-long, vinyl-coated cable can handle 100 pounds of pull. Just lock it onto your model's tail wheel, and loop the other end over an optional steel stake or any stationary object.

Part nos. GT-S (with stake); GT-O (without stake).

Price: $13.95; $11.75; CA residents add 7 percent sales tax.

For more information, contact Strand Products Inc., P.O. Box 4610, Santa Barbara, CA 93140; (805) 568-0304.

FAI MODEL SUPPLY
Saws

The Zona Saw Set (top) is three blades in one: the "sabre," the 4 1/2-inch-long razor and the 4 1/2-inch-long "homecraft." For even finer work, the Razor 42 Saw (middle) has 42 teeth per inch. It provides vastly improved cutting for wood and plastic. The Universal Saw (bottom) has a depth of cut of 1 3/16 inch and a thin blade with 32 teeth per inch, making it one of the most adaptable in the line.

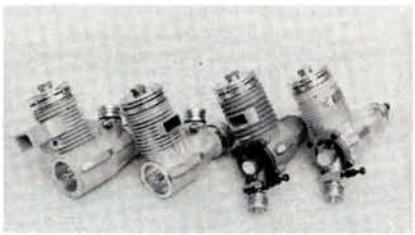
Part nos. 100 (Zona); 150 (Razor); 500 (Universal).

For more information, contact FAI Model Supply, P.O. Box 3957, Torrance, CA 90510.

LAIRDAIR
XL+2

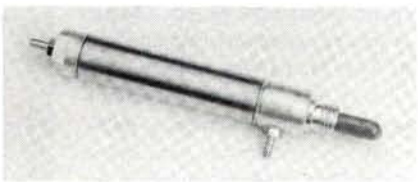
Designed for .60 to 1.20 engines, this plane is capable of precision aerobatics and docile control. Its wingspan is 68 inches, and it weighs 8.5 to 9.5 pounds. You'll spend about one third less time building the XL+2 than you would a conventional, built-up kit because a balsa/foam, laminated, formed "D"-section leading edge and turtle deck come already assembled. The main spar is built into the "D" section and is slotted for fast, true wing construction and alignment.

For more information, contact Tom Bookwalter, 3620 Cottonwood Cr., Manhattan, KS 66502; (913) 776-2304.



NELSON COMPETITION ENGINES
.15-Size Diesel Engines

Nelson has been producing high-performance, .15-size diesel racing engines (not glow conversions) for nearly 15 years. Although they were developed primarily for control-line use, you can easily convert them for R/C use with optional throttles available from Nelson. For more information, contact Nelson Competition Engines, 121 Pebble Creek Ln., Zelienople, PA 16063; (412) 538-5282.



SUPER SYLINDER
Air Cylinder

This new line of industrial-grade air cylinders can be used with Dave Platt retractable landing gear. The Super Sylinder has a stainless-steel body, bronze rod guide bushings and special cup seals that include a removable, barbed air fitting and gasket. It's durable, reliable and weighs only 1/2 ounce more than a standard cylinder. Custom air reservoirs are also available.

Price: $23.95

For more information, contact Super Sylinder, c/o Chris Mayher, 7555 Creekwood Dr., N. Royalton, OH 44133; (216) 237-3310.

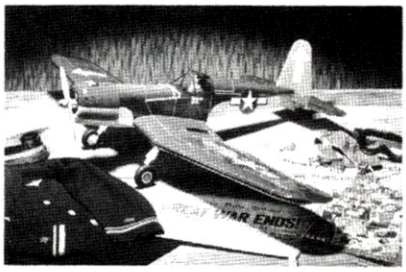
PRODUCT NEWS

BOB FIORENZE
Jet Smoker Fuel

Jet Smoker Fuel, specially blended by Morgan Fuels for Bob Fiorenze, is available with a nitro content of 7 or 12 percent. Both blends have an oil content of over 22 percent, 6 percent of which is castor. This fuel produces a long-lasting contrail that can help you identify your plane at busy or noisy flying sites. This fuel contains no synthetic oil and can be used in all sport engines.

Prices:$12.95/gallon (7-percent nitro); $14.95/gallon (12-percent nitro).

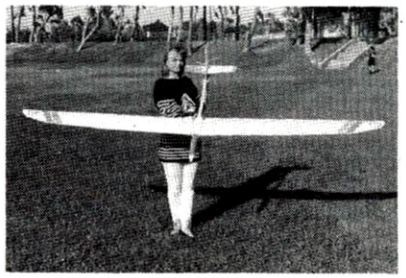
For more information, contact Fiorenze Hobby Center, 420 West State Rd. 434, Winter Springs, FL 32708; (407) 327-7148.



MIDWEST PRODUCTS
Corsair

The Corsair is maneuverable, gentle and easily slowed for stable, "no-surprise" landings. The kit comes with clean, uncluttered, computer-drawn plans, high-quality wooden parts, a jig-lock fuselage, a canopy, a molded cowl and two, large, full-color, fuel-resistant decal sheets. A tough, D-tube wing and an all-sheet tail enable you to build this plane quickly. It has a wingspan of 60 inches, a wing area of 552 square inches and a flying weight of 5 to 5½ pounds. It requires a 4-channel radio and either a .35 to .45 2-stroke or a .40 to .50 4-stroke engine.

For more information, contact Midwest Products Co. Inc., 400 S. Indiana St., P.O. Box 564, Hobart, IN 46342; (219) 942-1134.



GRECO TECHNOLOGIES
Modi 900

The Modi 900, an open-class competition sailplane that's made of modern composite materials throughout, has a 50-inch-long fiberglass and Kevlar fuselage. This plane was designed by an engineering and technical consulting firm for F3B, Sportsman competition and just plain fun! Wingspan: 116 inches; wing area: 949.21 square inches; weight: 81 ounces; wing loading: 12.29 ounces/square foot; choice of airfoils: RG15 or S3021 wing, S8020 stab. The kit comes pre-bagged or almost-ready-to-fly. All hardware is included.

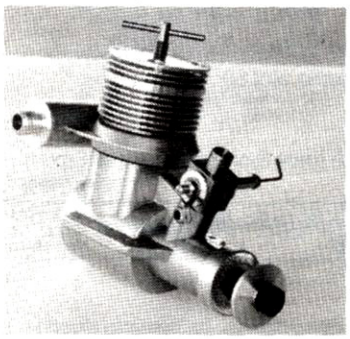
Price: $895

For more information, contact Greco Technologies, P.O. Box 10, South Pasadena, CA 91031; (800) 34-GRECO, ext. 23.

ESTES
Astro Blaster

Estes' Astro-Blaster Boost Glider is a conventional R/C boost-glider kit with wooden construction and foam wings. This capable slope ship performs aerobatic maneuvers. Controlled by a 2-channel radio, it can be launched to over 300 feet, and it uses "D" engines.

For more information contact Estes Industries, Penrose, CO 81240; (719) 372-6565.

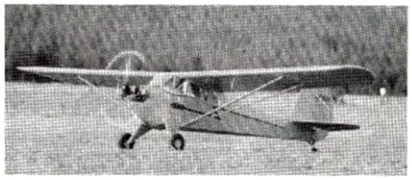


CARLSON ENGINE IMPORTS
60 TBR R/C Engine

This 21-ounce, .60 diesel, double ball-bearing engine comes with an R/C carburetor, a muffler and a factory guarantee. It's rated at 1hp at 9,000rpm and has a useful speed range from 1,500 to 11,000rpm. The recommended props range from 12x7 to 18x6.

Price: $190

For more information, contact Carlson Engine Imports, 814 East Marconi Ave., Phoenix, AZ 85022; (602) 868-1684.



IKON N'WST
Aeronca K

Ikon's ¼-scale Aeronca K is an accurate replica of the original. With a 108-inch wingspan, this model flies and lands well. The kit includes hand-cut balsa, spruce and plywood, pre-bent landing gear, inked drawings, fully drawn wing panels and shaped wing struts.

Price: $190 ($9.50 S&H)

For more information, contact Ikon N'wst, P.O. Box 306, Post Falls, ID 83854; (208) 773-9001.

Descriptions of products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to *Model Airplane News*, **Name That Plane Contest** (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Brian Allen of Sterling, VA, for correctly identifying the February issue's mystery plane—the 1943 prototype no. 2 of the Consolidated XB-32 "Terminator." We received 142 correct answers. Later renamed the "Dominator," the XB-32 was originally ordered with the B-29 as part of the USAF's very long range (VLR) bomber program. They were to complement the B-17 and B-24 squadrons being used in the European and Pacific conflicts. Known as "model no. 33" by Consolidated, to improve yaw stability, the tail on prototype no. 3 was changed to a single vertical fin and rudder configuration.

The production B-32 was the last U.S. heavy bomber to be sent into action in WW II before Japan surrendered. A total of 115 were built, but since the B-29 was such a success, at the end of the war, all work on the B-32 was halted and many orders were cancelled. Of note is that prototype no. 2 was disassembled and crated at the San Diego Consolidated plant for shipment to the Air Force Museum in Dayton, OH, where it would be displayed permanently, but it was accidentally scrapped in 1949! There are no B-32s or XB-32s around today, and very little information remains on file for this Terminator turned Dominator. ■

The winner will be drawn four weeks following publication from correct answers received (on a postcard delivered by U.S. Mail), and will receive a free one-year subscription to **Model Airplane News.** If already a subscriber, the winner will receive a free one-year extension of his subscription.

AIRWAVES

(Continued from page 122)

three-view. Any help you can give me would be greatly appreciated.

AUSTIN M. GOODWIN
Phoenix, AZ

Austin, tne best place we know of is Bob Banka's Scale Model Research, 2334 Ticonderoga Way, Costa Mesa, CA 92626; (714) 979-8058. His newest catalogue lists many P-40s, and he has a package that includes three-views and information on the "B" through "N" models. One of them has to be what your looking for. Good luck with your Flying Tiger. GY

A HELPING HAND

Now that I've joined your "Model Airplane" club and I've received your first magazine, I can assure you I'll stay with you for a long time. There are so many helpful hints and info that you can't find anywhere else. Your magazine makes me feel as though you've extended your hand across the miles and made me feel a part of your "family." I like that.

RICHARD DEPUIS
Belmont, NH

Thank you for the nice comment, Richard. We do our best to produce an informative, enjoyable magazine, and this is accomplished through a kind of "working partnership" with the many modelers who read and/or contribute to our pages. "Pilots Projects," "Hints and Kinks," "Airwaves" and special features like the Design Contest specifically involve modelers in the magazine. But we're also constantly on the lookout for methods and expertise that we can share with our readers. We feel we owe a debt of gratitude to the many modelers who are willing to share their accomplishments through the magazine and also feel lucky to belong to this particular club. TA

(Continued on page 130)

AIRWAVES

(Continued from page 127)

PAST PLANS

I have a unique problem that I hope you can help me with. I'm just getting back into R/C modeling after 10 years away from the hobby. I'd like to recapture my R/C roots (early 1960s), and I'm trying to locate plan sets for several classic models. I'm specifically looking for the following: Gerry Nelson's Sultan; Ed Kazmirski's Taurus; Ed Kazmirski's Tauri Trainer; Guillow's Explorer.

Would you please ask your readers to contact me if they have these plans for sale? If the owner doesn't wish to part with the plans, I'd be interested in making arrangements to have a duplicate made. Thanks in advance for helping an old-time R/Cer.

EDDIE WARREN
Carolina Beach, NC

Eddie, I know just the place to send you: the Vintage R/C Society. This group of enthusiasts is completely dedicated to older plane designs, engines and radios. I'm sure they'll be more than happy to help you out in your search for those hard-to-find plans. Contact John Worth, 4326 Andes Dr., Fairfax, VA 22030. GY

ADVERTISER INDEX